THE DIFFERENCES IN FUNCTIONAL RECOVERY BETWEEN PATIENTS WITH STROKE WHO ARE HIV POSITIVE AND THOSE WHO ARE HIV NEGATIVE

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DECLARATION

I, Jenny Janse van Rensburg declare that this research report is my own work. It is being submitted for the degree of Master of Science in Physiotherapy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

_____ (Signature of candidate)

_____Day of _____ , 2014.

DEDICATION

In loving memory of my mother, Glenda Ruth Janse van Rensburg (1953 – 1994).

“May I never get too busy in my own affairs that I fail to respond to the needs of others with kindness and compassion”

- Thomas Jefferson

ABSTRACT

Stroke is a significant contributor to disease worldwide and is the second highest cause of death in both men and women. Importantly, stroke is not only a common cause or mortality but also morbidity. This increased risk of suffering a stroke could lead to an increased number of individuals with functional limitations. The main objective in stroke rehabilitation is seen as aiding the patient to achieve their highest physical and psychological performance, with the ultimate goal of a stroke survivor being one of functional independence allowing them to return to their home and reintegrate into their community. The aim of this study is to describe the differences in functional abilities between patients with stroke who are HIV positive and those who are HIV negative admitted to Witrand rehabilitation unit in the North-West province of South Africa.

This is a retrospective longitudinal study utilizing the review of subject records. All subject files dating back to 21 April 2005 to December 2010 were analysed. Functional ability of patients with stroke was scored using the Beta assessment tool.The Beta assessment tool is one of three platform level tools designed by the South African Database for Functional Medicine (SADFM).It is an evidence – based scoring system which can convert a patient's functional abilities and behaviour into quantifiable data. Scores on admission and discharge were recorded to determine the presence of change in functional ability after having received rehabilitation. Demographic information and clinical characteristics of subjects were captured using a self-designed questionnaire. Data were analysed using both a two sample t-test and descriptive statistical tests.

Over the period, 2005 – 2010, 173 stroke survivors were admitted to the Witrand rehabilitation unit.Data from 32 patient files was excluded for not meeting the inclusion criteria; leaving data from 141 files to form our study group (n). The study group included 53.2% male and 46.8% female stroke survivors, with the mean age for stroke at 54.4 years and52.4 years for males and females respectively. Ischaemic strokes were more prevalent than haemorrhagic strokes (74.5% and 25.5% respectively) with hypertension asthe most common (31.9%) stroke risk factor. The mean age of stroke onset for a HIV positive individual was 39.6 years and 54.9 years for an individual without HIV.This study found that HIV positive individuals required on

average 7.5 days less to rehabilitate than an individual with HIV. This discrepancy could be a result of the notably younger HIV positive group. After receiving rehabilitation from a multidisciplinary team, the HIV positive group improved with an average of 40 points and the individuals without HIV by 38 points. When performing the various statistical tests there were in fact no significant differences between the two different clinical groups.

Despite the statistically insignificant findings when comparing the HIV positive and HIV negative group, when taking a closer look at the study groups demographics and clinical characteristics this study yielded interesting results. It could be argued that a majority of the HIV positive group were generally younger than the HIV negative group and perhaps the advantage of age on recovery could result in this group in gaining, on average, a similar number of points on the beta scale with those individual without HIV.Prior to their commencement of rehabilitation it should be taken into account that neurological recovery requires a degree of brain reorganization and that with age comes a certain degree of neuronal loss. Neuroplasticity is the ability of the central nervous system to respond to internal and external stimuli by reorganizing its structure, function and connections. Normal ageing is associated with a decline in and reduced plasticity. These negative changes can be experienced as reductions in processing speed, working memory and peripheral nervous system functions; all of which can be associated with poorer rehabilitation outcomes. Neural plasticity is crucial for functional recovery and this occurs more effectively and efficiently in younger individuals.However, in general the age for stroke onset was younger than that of developed countries thus stroke should no longer be considered an ‘old-age’ disease in developing countries.

Keywords: Stroke; Human Immunodeficiency Virus (HIV); Functional abilities

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6. To God be the Glory

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ABBREVIATIONS USED

UN United Nations**AIDS** Acquired Immundeficiency Syndrome

HIV Human Immunodeficiency Virus

WHO World Health Organisation

HAART Highly Active Antiretroviral Therapy

cART Combination Antiretroviral Therapy

TIA Transcient Ischaemic Attack

PAH Pulmonary Arterial Hypertension**ARV's** Antiretrovirals**CDC** Centre for Disease Control

ART Antiretroviral Therapy

DVT Deep Vein Thrombosis

HAD HIV-Associated Dementia

SADFM South African Database for Functional Medicine

ICF International Classification of Functioning, Disability and Health

D.O.A Date of Admission

D.O.B Date of Birth

D.O.I Date of Incident

L.O.S Length of Stay

Rx Treatment

HPT Hypertension

DM Diabetes Mellitus

CHAPTER 1

1. INTRODUCTION

1.1 Background and Need

Stroke is a significant contributor to disease worldwide (Cadilhac et al., 2010) and is the second highest cause of death in both men and women (Stuart-Sho et al., 2009). It is not only a common cause of mortality but also of morbidity. In general, stroke incidence is higher in Sub-Saharan Africa than in developed countries (Ogeng'o et al., 2010). Hypertension, diabetes, obesity and hypercholesterolemia are known risk factors of stroke to which prevention has been focussed; however, viral infections appear to be an emerging risk factor of stroke (Nagel et al., 2010).Recovery post-stroke involves complex rehabilitation and thus differs from person to person. Neurological recovery occurs mainly within 1-3 months post stroke, whilst functional recovery occurs more fully at 4-6 months (Schaechter, 2004). The coexistence of psychosocial and cognitive impairments, as well as a broad range of other neurological and sociodemographic factors has been seen to affect the functional recovery of stroke survivors (Saxena et al., 2006). The main objective in stroke rehabilitation is seen as aiding the patient to achieve their highest physical and psychological performance, with the ultimate goal of a stroke survivor being one of functional independence allowing them to return to their home and reintegrate back into their community (Kwakkel et al., 2004).

There are 35 million people living with HIV of which 24.7 million are living in Sub-Saharan Africa (The Gap Report, 2014). New HIV infections are declining however, with only 2.1 million new infections in 2013. This is a 38% decline from 2001 (The Gap Report, 2014). Almost half of all people living with HIV know their status (The Gap Report, 2014). Approximately 86% of people living with HIV who know their status in Sub-Saharan Africa are receiving antiretroviral therapy (The Gap Report, 2014). South Africa is regarded as having the world's largest population of people living with AIDS, with a prevalence of 18% recorded by the World Health Organisation (Global Report, 2013). An estimated 2.1 million individuals became infected with HIV in 2013 worldwide (The Gap Report, 2014).An individual with HIV will go through periods of both wellness

and illness, but HIV will always have a physical, psychological and social impact (Rusch et al., 2004).

There is a greater prevalence of cerebrovascular risk factors in Human Immunodeficiency Virus (HIV)infected individuals (Foley et al., 2010). This increase is believed to be caused by the negative effects of antiretroviral therapy, increasing age and the direct impact of the HIV itself (Foley et al., 2010). Early onset atherosclerosis, diabetes, lipodystrophy, hypertension and myocardial infarcts have been linked to treatment with antiretroviral drugs (Qureshi, 2005). Neurological symptoms are the first manifestation of HIV infection in 10% - 20% of patients (Mochan et al., 2003). Within the HIV infected population, stroke affects male to females at a ratio of 1.5:1 with a mean age of 32.1 years in the female population. Ninety four percent of these strokes are cerebral infarcts and 6% are intracranial cerebral haemorrhages with a younger population being affected by HIV (Mochan et al., 2003).

Depression is often seen in patients with HIV with statistics showing that approximately 60% suffer from this disease. Motivational levels to participate in the rehabilitation process could be affected due to this (Dudgeon et al., 2004). Patients with HIV are treated using Highly Active Antiretroviral Therapy (HAART) whoseside-effects could indirectly affect their quality of life (Dudgeon et al., 2004). This may be as a result of wasting syndrome which is defined as involuntary loss of weight equivalent to less than 10% of their baseline body weight in addition to prolonged fever, chronic weakness and chronic diarrhoea (Dudgeon et al., 2004). This leads to a significant loss of tissue, muscular strength and functional recovery (Dudgeon et al., 2006).

A large number of individuals infected with HIV are also found to suffer from anaemia resulting in weakness and fatigue (Dudgeon et al., 2004). All co-morbidities mentioned could result in reduced energy levels, weakness and poor motivation, thus affecting the individual's recovery.In the context of this study, the term 'recovery' should be understood as the regaining or possibility of regaining function that was lost. In a study done by Hama et al. (2007), depression and apathy were found to be predictors of poor

functional recovery post-stroke. Fang et al. (2003) found that early prediction of functional recovery is an important factor in planning rehabilitation resources.It is at this point that the term 'functioning' be defined, using the ICF framework, as: "an umbrella term for body function, body structures, activities and participation. It denotes the positive or neutral aspects of the interaction between a person's health conditions and that individual's contextual factors (environmental and personal factors)" (WHO, 2001). Therefore the aim of this study was to determine the differences in functional status between patients with stroke who are HIV positive and those who are HIV negative.

1.2 Problem Statement

HIV is quite prevalent in our society and affects many individuals within the working age population. No studies have been done to determine if there are any differences in functional recoverybetween patients with stroke who are HIV positive and those who are HIV negative.

1.3 Research Question

What is the difference in functional recoverybetween patients with stroke who are HIV positive and those who are HIV negative?

1.4 Aim of the study

To describe the differences in functional abilitiesbetween patients with stroke who are HIV positive and those who are HIV negative admitted to Witrand rehabilitation unit in the North-West province of South Africa.

1.5 Objectives of the study

1.5.1 To describe the population demographics and clinical characteristics of patients with stroke admitted to the Witrand rehabilitation unit.

1.5.2 To establish and compare the functional abilities of patients who are HIV positive with those who are HIV negative on admission to the Witrand rehabilitation unit.

1.5.3 To establish and compare the functional abilities of patients who are HIV positive with those who are HIV negative on discharge from the Witrand rehabilitation unit.

1.5.4 To compare the functional change in ability of patients who are HIV positive and those who are HIV negative on discharge from Witrand rehabilitation unit

1.6 Significance of the study

Determining the differences in functional recovery between patients with stroke who are HIV positive and HIV negative will provide valuable information regarding a more effective distribution of resources to rehabilitation units. If patients who are HIV positive are found to be less functional compared to those who are HIV negative given the known physiological effects of the disease on the body, this could affect length of inpatient rehabilitation stay, number of post-discharge follow-up sessions and applications for disability grants. This study may highlight the areas that need further attention from healthcare providers to optimise rehabilitation outcomes among this group of patients.

1.7 General Outline of Research Report

The general outline of this research report is given below:

Chapter 2: Literature review

Chapter 3: Methodology

Chapter 4: Results

Chapter 5: Discussion

Chapter 6: Conclusion and recommendations

CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction

Essentially this report focuses on the differences in functional recovery between patients with stroke who are HIV positive and those who are HIV negative. The individuals within the study group all have one thing in common in that they have suffered a stroke and the differing factor is that of the existence or non-existence of the HIV. The treatment and care of an individual that has suffered a stroke requires specialised care and resources. Unfortunately in South Africa where an estimated 120 neurologists exist for a population of 30 million our resources are stretched very thin (Fritz, 2006). Only ± 10 – 20% of the population have access to rehabilitation units and with general stroke knowledge being poor in the country, complete rehabilitation is not often available (Fritz, 2006). So the question remains, how do we provide for these two chronic illnesses often in co-existence?

This literature review has been developed to allow the researcher to gain an in-depth view of the study matter and material already discussing this conundrum to provide an understanding and knowledge to help ensure that the study is supported and enriched with value that will provide others with further information and findings regarding this field. In doing so the following search engines and databases were used: Google Scholar, EBSCO Host (Medline, Academic Search Complete, CINAHL Plus, Education Research Complete, ERIC, Global Health, Health Source: Nursing/Academic Edition, SocINDEX).

The literature review was done under the following subheadings:

2.2 Pathophysiology and classification of HIV/AIDS

2.3 Epidemiology of HIV/AIDS

2.4 Impact of HIV/AIDS on the individual and the community

2.5 Definition and classification of stroke

2.2 Pathophysiology and Classification of HIV/AIDS

Clinical characteristics of AIDS were first identified by scientists from the United States of America in 1981 (www.avert.org, 2012). The HIV which causes AIDS was only discovered two years later in 1983 (www.avert.org, 2012). The HIV/AIDS epidemic has now spread to every corner of the globe.

Senocak et al. (2010) found HIV to originate from a group of viruses known as retroviruses, or more simply put – slow viruses as the time from initial infection to the appearance of clinical symptoms can take years. This means that the effects of the virus can remain undetected until the patient is eventually diagnosed with advanced AIDS, the end or last stage of the HIV disease.

The workings of the HIV is very specific in nature. Upon entering the blood stream it primarily infects a group of immune cells known as activated CD4+ lymphocytes and begins to replicate rapidly, secondarily it also infects the macrophages that are also important role players in the body's immune system (Ellis et al., 2009). Although infected macrophages are far fewer in number than the already mentioned lymphocytes, they are still considered as being important in the composition of the central nervous system (Ellis et al., 2009).

Despite its global effects on the body, it is most often central nervous system abnormalities that are considered as the first signs of infection (Ellis et al., 2009). HIV can

cause central nervous system diseases in one of two ways:

a) through primary HIV central nervous system diseases for which the virus is actually necessary and sufficient.

b) through secondary central nervous system diseases which require an opportunistic pathogen that can take advantage of progressive immune deficiency (Ellis et al., 2009).

HIV does not directly infect neurons, but rather causes damage indirectly by infecting macrophages and other cells (Ellis et al., 2009; Mochan et al., 2003). The onset of opportunistic infections such as tuberculosis is also a common first clinical sign of HIV/AIDS.The HIV/AIDS is a progressive disease often moving through various stages unbeknownst to the infected individual. At present there is no cure for HIV/AIDS therefore treatment has been aimed at halting the replication of this retrovirus at various stages in its life-cycle (Ellis et al., 2009).

There are two main methods of classifying HIV as it progresses through its various stages. The classification systems used are that of the WHO and United States Centres for Disease and Prevention,but the WHO classification system appears to be the most user friendly and stands to be the most popular system.

Below are the two classification systems:

Table 2.1: Classification system for HIV infected individuals (Centres for Disease Control and Prevention, USA)

CD4 Cell Categories	Clinical Categories		
	A Asymptomatic, Acute HIV, or PGL	**B*** Symptomatic Conditions, not A or C	**C**[#] AIDS-Indicator Conditions
(1) ≥500 cells/mm³	A1	B1	C1
(2) 200-499 cells/mm³	A2	B2	C2
(3) <200 cells/mm³	A3	B3	C3

Abbreviation PGL = persistent generalized lymphadenopathy

(Adapted from www.aidsetc.org, 2012)

The CDC assesses the severity of HIV by taking into account the CD4+ count as well as the presence of very specific HIV-related conditions *(see below).* It was revised in 1993. It is quite an intricate way of classification requiring CD4+ counts and other diagnostic test results.

Table 2.2: Clinical staging and disease classification system for HIV infected individuals (WHO)

Primary HIV Infection
Asymptomatic Acute retroviral syndrome
Clinical Stage 1
Asymptomatic Persistent generalized lymphadenopathy
Clinical Stage 2
Moderate unexplained weight loss (<10% of presumed or measured body weight) Recurrent respiratory infections (sinusitis, tonsillitis, otitis media, and pharyngitis) Herpes zoster Angular cheilitis Recurrent oral ulceration

Papular pruritic eruptions
Seborrheic dermatitis
Fungal nail infections
Clinical Stage 3
Unexplained severe weight loss (>10% of presumed or measured body weight)
Unexplained chronic diarrhea for >1 month
Unexplained persistent fever for >1 month (>37.6ºC, intermittent or constant)
Persistent oral candidiasis (thrush)
Oral hairy leukoplakia
Pulmonary tuberculosis (current)
Severe presumed bacterial infections (e.g., pneumonia, empyema, pyomyositis, bone or joint infection, meningitis, bacteremia)
Acute necrotizing ulcerative stomatitis, gingivitis, or periodontitis
Unexplained anemia (hemoglobin<8 g/dL)
Neutropenia (neutrophils <500 cells/µL)
Chronic thrombocytopenia (platelets <50,000 cells/µL)
Clinical Stage 4 / AIDS
HIV wasting syndrome
Pneumocystis pneumonia
Recurrent severe bacterial pneumonia
Chronic herpes simplex infection (orolabial, genital, or anorectal site for >1 month or visceral herpes at any site)
Esophageal candidiasis (or candidiasis of trachea, bronchi, or lungs)
Extrapulmonary tuberculosis
Kaposi sarcoma
Cytomegalovirus infection (retinitis or infection of other organs)
Central nervous system toxoplasmosis
HIV encephalopathy
Cryptococcosis, extrapulmonary (including meningitis)
Disseminated nontuberculosis mycobacteria infection
Progressive multifocal leukoencephalopathy
Candida of the trachea, bronchi, or lungs
Chronic cryptosporidiosis (with diarrhea)
Chronic isosporiasis
Disseminated mycosis (e.g., histoplasmosis, coccidioidomycosis, penicilliosis)
Recurrent nontyphoidal *Salmonella* bacteremia
Lymphoma (cerebral or B-cell non-Hodgkin)
Invasive cervical carcinoma
Atypical disseminated leishmaniasis
Symptomatic HIV-associated nephropathy
Symptomatic HIV-associated cardiomyopathy
Reactivation of American trypanosomiasis (meningoencephalitis or myocarditis)

(Taken from www.aidsetc.org, 2012)

The WHO classification system (revised in 2007) can be easily used in resource-constrained settings without requiring access to the CD4+ cell counts or other diagnostic test results. The infected individual is classified purely on clinical manifestations. This method is used by many countries to determine initiation of Anti-retroviral therapy.

2.3Epidemiology of HIV/AIDS

Over the past 3 years alone, new HIV infections have fallen by 13% (The Gap Report, 2014). Approximately 86% of people living with HIV who know their status in Sub-Saharan Africa are receiving antiretroviral therapy (The Gap Report, 2014). More than five million individuals in low and middle income countries have been receiving this therapy since 2004 (Global Report, 2010). Thirty fivemillion individuals were living with HIV globally at the end of 2012, of which 24.7 million were adults (15 – 49 years of age) living in Sub-Saharan Africa (The Gap Report, 2014). Sub-saharan Africa remains the most severely affected region with ± 1 in every 20 adults (4.9%) living with HIV, and thus accounts for 71% of all individuals living with HIV worldwide (The Gap Report, 2014). Regions most heavily affected, following Sub-Saharan Africa, are the Caribbean, Eastern Europe and Central Asia(Global Report, 2012).

In 33 countries there has been more than a 38% fall in HIV incidence from 2001 (The Gap Report, 2014). Countries in Sub-Saharan Africa account for 22 out of the 33 countries. Countries such as Ethiopia, Nigeria, South Africa, Zambia and Zimbabwe have begun to show signs of stabilisation or decline in HIV incidence (Global Report, 2010). The sharpest declines have been observed in the Caribbean (42%) and Sub-Saharan Africa (25%).

But all is not well globally. The number of newly infected individuals is declining globally, but national epidemics continue to expand in areas of the world (Global Report,2012). In seven countries, five of which are in Eastern Europe and Central Asia, HIV incidence has increased by more than 25% between the years 2007 and 2009 (Global Report, 2010). Since 2001 the number of newly infected individuals in the Middle East and North Africa has risen by more than 35% (Global Report, 2012). The number of annual AIDS-related deaths worldwide has fallen by 35% since 2005 (The Gap Report, 2014).

Below is a summary of the HIV/AIDS epidemic according to various regions as taken from the UNAIDS factsheets from their Global Report for 2010 and 2012, 'The Gap Report 2014' as well as a study on South African National Burden of disease study– The North-West Provincial profile(2000):

2.3.1Sub-Saharan Africa

It was noted that the HIV incidence is stable or declining. South Africa experienced a decrease in new HIV infections by > 25% over the period 2001 – 2009. HIV prevalence in West and Central Africa remained low in 2009, at or under 2% in twelve countries. An estimated 24.7 million individuals with HIV resided in Sub-Saharan Africa in 2013; this figure represents ± 71% global HIV burden.

2.3.2 South Africa

South Africa continues to have the world's largest HIV epidemic with an estimated 5.6 million individuals living with HIV. The prevalence of HIV varies greatly across the nine provinces. The highest rate is found in KwaZulu Natal which remained stable at 39.5% for 2009 and 2010. However, the number of new infections overall for 2011 in individuals older than fifteen years old was 316 900.

2.3.3 North-West Province

The North-West province makes up 6.43% of the South African population. In adults (49 – 59 years of age) HIV/AIDS was responsible for the largest number of deaths in men and second largest cause of death in women.

2.4Impact of HIV/AIDS on the Individual and the Community

HIV has both a clear physical impact on the body as well as a psychological impact. In as much as the title of this study focuses on the physical effects of HIV, for physical rehabilitation we need an individual that can actively partake in the rehabilitation process thus requiring adequate cognitive functioning. Literature covering both areas was thus studied. One of the most visible signs of HIV is that of the wasting syndrome (Dudgeon et al., 2006), defined as: "involuntary weight-loss of more than 10% baseline body weight in addition to prolonged fever, chronic weakness, & chronic diarrhoea". This is one of the

physiological effects of the virus and may include a high prevalence of anaemia, up to 28% in this population. This negatively impacts on patients' rehabilitation as they are physically weak (Rusch et al., 2004).

Furthermore the virus may have an impact on the digestive tract (Dudgeon et al., 2006), leading to a high prevalence of gastrointestinal disorders in the HIV infected group. The virus itself also has the ability to cause atrophy of the digestive tract villi and thus reduce the surface area through which absorption takes place. This can easily result in diarrhoea and may worsen the symptoms of dehydration (Dudgeon et al., 2006; Rusch et al., 2004). Swallowing disorders can be present in up to 47% of infected individuals. In this case, they have a decreased ability to chew and swallow food. Some individuals also seem to struggle in performing activities of daily living due to poor nutrition (Dudgeon et al., 2006). Swallowing may become painful, oral and oesophageal lesions may cause dysphagia and anorexia purely through the blocking of the glottis and reducing the size of the oesophagus. All of this could result in severe fatigue and a reduced functional ability for the individual to complete some common activities of daily living such as preparing meals or even shopping for healthy food options (Dudgeon et al., 2006; Rusch et al., 2004).

Cognitive impairments have been recognised as a symptom of HIV (Robinson – Papp et al., 2008) and neurological symptoms are often the first manifestation of the disease (Mochan et al., 2003). Human immunodeficiency virus – associated neurocognitive disorders are characterised by a triad of cognitive, behavioural and motor dysfunction (Ances et al., 2008; Woods et al., 2009). The ability to distinguish the cognitive outcomes of being infected by HIV from other co-morbidities is becoming problematic. However, Robinson-Papp et al. (2008)'s study showed that motor and behavioural abnormalities are associated with and can help predict cognitive impairments in an infected individual. Some of these cognitive impairments include: loss of concentration, distractibility and repetitive reminders(Moore et al., 2011; Ances et al., 2008). These may encroach on activities of daily living making them laborious. The HIV positive population also has an increased incidence of anxiety and depression, which reduces motivation and drive in an

individual if undertaking rehabilitation with the added negative effect on drug adherence leading to faster disease progression (Dudgeon et al., 2006).

Ances et al. (2008) listed common motor symptoms which include: slowed repetitive movements, clumsiness, unsteady gait, and balance problems; as well as neurological disturbances such as those caused by central nervous system tumours, dementia, myelopathy, painful sensory neuropathy and myopathy (Mochan et al., 2003).

With the introduction of anti-retroviral therapy HIV related patient mortality has reduced but this life extending treatment has severe side-effects which could also affect their quality of life (Dudgeon et al., 2004). Rusch et al. (2004) identified 'cycles of illness and wellness' for those on treatment, but more importantly found that infected individuals' quality of life was affected in physical, psychological and social spheres of life.

Rusch et al. (2004) did a questionnaire based study using the International Classification system in British Columbia to investigate the presence and severity of impairments, activity limitations, and participation restrictions within this population group. The results are tabulated below:

Table 2.3: Prevalence of ICF domains affected by HIV as reported by cohort in British Columbia

Impairment	**Activity Limitation**	**Participation Restriction**
Mental Health disorders (62.9%) Mental Impairment (78.2%) Sensory Impairment (71.9%) Neuromuscular Impairment (49.5%) Internal Impairment (81%)	Vigorous and moderate activities, sexual activities and household chores were the most common. (80.6%)	High for all CD4 categories b sexual roles, student/employee roles and financial roles were most prevalent. (93.2%)

The most prevalent impairments experienced were diarrhoea (57.1%), reduced libido (55.8%), general weakness (48.2%), poor concentration (47%), chronic fatigue (46.6%)

and headaches (46.9%). Pain was reported by half of the population, and of this group > ¾ had a CD4+ cell count of ≤ 200 cells / mm^3. Moderate or severe pain was experienced by approximately 37.1% and little or mild pain by ± one third of the population (Rusch et al., 2004). This study also showed that categorisation into groups based on CD4+ cell counts did not reflect a relationship with the disability they experienced or their perception of their health.

Earlier, the impact of stroke on the individual was discussed and there are many similarities seen between those and the impact of HIV on the individual. Strong similarities are found in the emotional and cognitive effects of these two diseases. There is a common finding of depression which effects the individual's motivation and drive which in turn affects their desire to actively partake in the rehabilitation process. This is worsened by HIV as itresults ina host of physiological co-morbidities such as wasting syndrome, anaemia and dehydration which physically results in patient lethargy and causing them to retreat from physical activity.

2.5 Definition and classification of stroke

The World Health Organisation (WHO) defines stroke (also known as a cerebrovascular accident/incident) as "rapidly developing clinical signs of focal, or at times global disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin" (WHO, 2002). Post stroke, brain tissue is damaged due to a lack of oxygen and nutrients to the brain (WHO, 2002).

There are two main types of stroke which are ischaemic and haemorrhagic stroke. Ischaemic stroke occurs from a blocked artery while haemorrhagic stroke occurs from a burst artery or vein. Over two-thirds of strokes are of an ischaemic nature, affecting either small vessels or large vessels (Chestnut, 2011). Small vessel blockages result in lacunar infarcts that present with a specific clinical syndrome, but with better functional status and prognosis post-stroke versus large vessel blockages, which affect a wider area of cerebral cortical impairment (Chestnut, 2011).

It is well documented that ischaemic strokes occur more frequently than haemorrhagic strokes within the general population (Lee et al., 2011;Turanjanin et al., 2011;Spengos and Vemmos, 2010; Appelros et al., 2009; Cabral et al., 2009). What we are still trying to understand more are HIV-associated strokes. Benjamin et al. (2012) looked into current perspectives of stroke in HIV positive individuals and found that ischaemic strokes were more common in HIV positive individuals with stroke. A longitudinal study done in the United States from 1997 to 2006 confirmed that the number of patients with stroke who were HIV positive increased dramatically by 43% and this coincided with the introduction of combination antiretroviral therapies (cART) in the mid 1990's (Benjamin et al., 2012). Benjamin et al. (2012) made a solid statement when they commented on ischaemic strokes appearing more frequently in HIV positive patients than the haemorrhagic type in hospital-based studies performed in Sub-Saharan Africa. This is supported by findings from research performed by Longo-Mbenza et al., 2011;OvbiageleandNath, 2011;Oritz et al., 2007; Tipping et al., 2007; Qureshi, 2005.

Ovbiagele and Nath (2011) also made note that there was a ± 67% rise in proportion of patients hospitalised for ischaemic stroke who were HIV positive in the United States, the number of patients more than doubled between the years 1997 and 2006. A study based at Groote Schuur Hospital, Cape Town, South Africa; identified 42% of their HIV positive study participants' first ever stroke was in fact the clinical event which resulted in their initial diagnosis of HIV (Tipping et al., 2007). The ischaemic and haemorrhagic relationship followed the general trend at 96% versus 4%.

The HIV-associated ischaemic stroke risk factor profile differed significantly from the general population as hypertension, diabetes, hypercholesterolemia and smoking were not significant risk factors (Tipping et al., 2007). In fact infections were found to be the most common cause, accounting 28% of the ischaemic strokes. There are various mechanisms that could result in ischaemic stroke in the HIV positive group, such as: opportunistic infections in immune-compromised individuals, vasculopathies, cardioembolisms and coagulopathies (Benjamin et al., 2012; Longo-Mbenza et al., 2011; OvbiageleandNath, 2011;Oritz et al., 2007; Tipping et al., 2007;Qureshi, 2005). Along with these mechanisms,

to be discussed in greater detail at a later stage, the global use of cART in HIV positive patients increases life expectancy and thus their risk for an ischaemic stroke due to its high correlation with age (Obviagele and Nath, 2011).

Care should be taken not to confuse stroke with a Transient Ischaemic Attack (TIA).The American Heart Association/American Stroke Association endorsed definition of a TIA as follows: “TIA is a transient episode of neurological dysfunction caused by a focal brain, spinal cord, or retinal ischaemia without acute infarction” (Nentwich et al., 2012). Despite the lack of permanent brain damage, TIA’s are a serious warning sign of stroke. The aetiology of a TIA is similar to that of a full blown ischaemic attack, with the difference lying in the fact that the blockage of the blood vessel is not permanent and clears sporadically. The blockage can be a result of one of three causes: (1) low blood flow at a narrow part of a major artery carrying blood to the brain, (2) blood clot in another part of the body breaks off, travels to the brain and blocks a blood vessel in the brain, (3) narrowing of smaller blood vessels in the brain, blocking blood flow for a short period of time, usually caused by plaque build-up (www.stroke.org, 2012).

2.6 Epidemiology of Stroke

By 1990, stroke was seen as the commonest cause of mortality worldwide, totalling approximately 4.4 million deaths, two-thirds occurring in less developed countries, which would include South Africa (Modi, 2008). About 60% of all deaths in 2002 were due to stroke (Burke et al., 2006). Approximately 60% of global mortality resulted from stroke in 2002. Stroke was responsible for three million deaths in the East Asian Region (Burke and Venketasubramanian, 2006).

Non-communicable diseases are a leading cause of global mortality resulting in 67% of all deaths the world over in 2008 (Smith Jr, 2011); the greatest increase occurring in low- and middle income countries. Stroke mortality has decreased in industrialized countries allowing for stroke-related disabilities to increase (Turanjanin et al., 2011; Bhalla et al., 2009; Tobias et al., 2007; Paul et al., 2007; Truelson et al., 2006). Stroke is also associated with expensive medical expenses, lost labour productivity and this

can all lead to family poverty (Wang et al., 2009).

A study performed using young adults from Athens found that, compared to other studies, it is generally accepted that post-stroke functional outcome amongst the youth is good (Spengos and Vemmas, 2010). However, Lee et al. (2011) found that a minority of young Koreans returned to work post-stroke even after receiving treatment and management. In Brazil, Cabral et al. (2009), reported on patient presentation six months post-stroke and discovered the following: (1) 25% had died (2) 13.5% were fully dependent (3) 61.5% were living independently. According to WHO 2020 projections, stroke will remain the second most common cause of mortality worldwide (Stroebele et al.,2011; Turanjanin et al., 2011; Burke and Venketasubramanian, 2006) despite it being a highly preventable disease (Tobias et al., 2007). Developing nations are at different stages in the 'epidemiologic health transition'. The epidemiologic health transition involves degenerative and chronic diseases replacing infectious pandemics as the primary causes of morbidity and mortality (Noah et al., 2011; Burke and Venketasubramanian, 2006). However, improved understanding and management of stroke has resulted in a decline in stroke mortality. From 1996 to 2006, stroke mortality fell by 33.5% and the actual number of stroke deaths declined by 18.4% (AHA, 2012).

Hospital based surveillance studies were performed in Afghanistan and Nepal focussing on the risk factors of stroke (Bhalla et al., 2009). However hospital surveillance studies alone are not reliable as not all patients with stroke present to hospitals or stroke units (Canto-Brito et al., 2011; Spengos and Vemmas, 2010; Tobias et al., 2007). Canto-Brito et al. (2011) tried to overcome this challenge by performing a door-to-door capture of stroke cases in Mexico. A prevalence of probable/verified stroke of 7.7/1000 was found with a cumulative stroke incidence of 232.3/1000 (Canto-Brito et al., 2011). Burke and Venketasubramanian (2006) did a study in East Asia and found the following: out of 1 321 733 individuals ≥ 35 years of age, 4995 were recorded as suffering a first ever stroke; the age and sex-standardised incidence ranged between 201 and 483. The incidence of Canto-Brito et al. (2011) study lies within the range of Burke and Venketasubramanian (2006)'s findings. Stroke incidence was also highly correlated with

increasing age (Carbal et al., 2009; Paul et al., 2007; Burke and Venketasubramanian, 2006).

Geographical components seem to have some form of influence in stroke incidence in China, Taiwan and Japan (Cabral et al., 2009; Burke and Venketasubramanian, 2006) with the average incidence in these countries being higher than Western Europe and the United States. Despite previous reports of ischaemic strokes occurring more frequently than haemorrhagic stroke, the opposite is found to be true in Asian countries (Burke and Venketasubramanian, 2006; Spengos and Vemmas, 2010; Lee et al., 2011).

When researching incidence and prevalence of stroke, gender appeared to dominate data regarding incidence and prevalence; as well as the data regarding type of stroke suffered (Lee et al., 2011; Noah et al., 2011; Stroebele et al., 2011; Spengos and Vemmas, 2010; Appelros et al., 2009;Cabral et al., 2009; Tobias et al., 2007; Burke and Venketasubramanian, 2006). Incidence rates appear to be generally higher across all age groups in males than females, however, the stroke types suffered differ in that males show a greater tendency for ischaemic and intracerebral haemorrhages and females, subarachnoid haemorrhages (Lee et al., 2011; Turanjanin et al., 2011; Appelros et al., 2009;Cabral et al., 2009; Tobias et al., 2007; Truelsen et al., 2006).

There also appears to be a dissimilarity in the ages of stroke onset between males and females (Spengos and Vemmas, 2010; Appelros et al., 2009; Lee et al., 2009;Tobias et al., 2007; Burke and Venketasubramanian, 2006). Tobias et al. (2007) found that the average male onset of stroke was 68.9 years and 73.3 years for females, with males having ± 20% higher prevalence rates than that of females (Tobias et al., 2007). Spengos and Vemmas (2010) reported that the mean age of onset for both genders was 36.9 ± 7.2 years, but care should be taken when comparing this study to Tobias et al. (2007) as Spengos and Vemmas (2010) only performed their study on a population aged 15 years to 45 years. Appelros et al. (2009) discovered that males are generally younger than females when they experience their first stroke, with females experiencing their first stroke, on average, 4.3 years later than men.

It is clear that non-communicable diseases still pose a great threat to the world over. The different aspects of stroke epidemiology touched on indicate that it is a disease that does not demonstrate bias and thus can be seen as a very real life altering disease.

2.7 Aetiology and Risk Factors of Stroke

Ischaemic and haemorrhagic strokes are heterogenous multifocal diseases and thus occur as a result of not one risk factor but many (Silverstrelli et al., 2006). The term 'risk factor' was defined by Turanjanin et al. (2011) as phenomena that lead to pathological changes over a period of time and significantly affect the absolute risk, i.e. the probability of getting a disease. In essence stroke is a lifestyle disease and many factors can increase or decrease stroke risk (Bhalla et al., 2009).

There is insufficient literature on HIV and stroke to state direct causality between the two conditions. There is however enough data to claim that HIV can be associated with the cause of a stroke. Benjamin et al. (2012) proposed that HIV can lead to a stroke in one of two ways:

i. Indirectly: cardioembolism, coagulopathy or non-infective vasculitis

ii. Directly: HIV-associated vasculopathy

Research by Benjamin et al. (2012) was supported by studies conducted by Ovbiagele&Nath (2011), Longo-Mbenza et al. (2011), Oritz et al. (2007), Tipping et al. (2007)and Qureshi (2005). Below is a summary of the proposed association between HIV and stroke identified by these researchers:

(a) Coagulopathy

HIV has the ability to predispose an individual to arterial or venous thrombosis, but to what extent is unclear.

(b) Cardioembolism

It accounts for 4 – 15% of ischaemic strokes in individuals with HIV. HIV-associated dilated cardiomyopathy is a frequently reported cause of cardiac disease, particularly in Sub-Saharan Africa. This disorder may be associated with opportunistic infections due to immunosuppression caused by HIV. However, the pathogenesis is uncertain.

(c) Opportunistic infection

Infections e.g. mycobacterium tuberculosis, syphilis and varicella zoster virus are well-known causes of stroke in HIV negative patients. HIV, however, causes immunosuppression thus increasing the individuals susceptibility to reactivation of infections. Combined antiretroviral therapy might also unmask other unknown opportunistic infections that subsequently cause stroke.

(d) HIV-associated vasculopathy

This is a relatively new term used to describe arterial changes associated with HIV infection. Researchers suggest that due to the uncertain nature of its pathogenesis of vasculitis, all arterial abnormalities thought to be associated with stroke should also be regarded as part of an HIV-associated vasculopathy. Human immunodeficiency virus infection can be associated with accelerated large-vessel atherosclerosis, potentially caused by cART and associated metabolic complications i.e. dyslipidaemia or diabetes (well-known modifiable risk factors in HIV negative individuals).

It was also found that stroke risk is not only associated with HIV infection but also its treatment. Combined antiretroviral therapy can cause direct or indirect tissue injury to the arteries, but again this relevance is unknown.

Literature has grouped stroke risk factors into modifiable and non-modifiablerisks. Below is a table grouping the various risk factors (Stroebele et al., 2011):

Table 2.4: Risk Factors of Stroke

Modifiable	***Non-modifiable***
Hypertension	Age
Diabetes	Gender
Smoking	Family history
Dyslipidaemia	
Obesity	
Alcohol consumption	

Hypertension is the most important risk factor, affecting 80% of stroke survivors (Rigby et al., 2009) and 51.5% in a study by Lee et al. (2011). Untreated hypertension ranged 24.9% to 33% (Cabral et al., 2009).This finding is important if we compare it to the number of individuals affected by hypertension. There appears to be a strong association between hypertension and resultant ischaemic strokes (Lee et al., 2011; Noah et al., 2011; Turanjanin et al., 2011; Spengos and Vemmas et al., 2010; Cabral et al., 2009). The risk of developing an ischaemic stroke in individuals with hypertension is estimated to be 3 to 4-fold greater (Turanjanin et al., 2011). When vascular risk factors were considered, hypertension was again considered as a strong predictor for stroke (Smith Jr, 2011). Different risk profiles were found between the genders, with a greater number of females having hypertension as a risk, but the researchers could not confidently say if this was due to biological or lifestyle differences (Dearborn and McCullough, 2009). Even in developing countries the future burden of stroke is likely to increase due to the increase in the prevalence of hypertension (Das et al., 2007). In rural Africa, hypertension was again found to be the most important risk factor of stroke (80%), however, the awareness of this fact needs to be improved through community education (Wasserman et al., 2009).

A study based in France concentrating on pulmonary arterial hypertension (PAH) established HIV as a risk factor for this subtype of hypertension. Pulmonary arterial hypertension results from the chronic obstruction of small pulmonary arteries, this then leads to right ventricular failure and eventually death (Sitbon et al., 2008).Males with HIV are more likely to be affected by PAH (Speich et al., 2001; Sitbon et al., 2008). Both studies cited above also found that the number of patients with CD4+ counts < 200 cells/mm^3 was found to be greater in these individuals with PAH. Speich et al. (2001) ascertained that those individuals with HIV-associated PAH had significantly poorer survival rates compared to a matched group of HIV individuals without PAH.

Age was determined as the most important non-modifiable risk factor by Bhalla et al. (2009) in a study set in Nepal. This study found that in an aging population with an increased life expectancy there would be an increase in predisposition for stroke. In reading the available literature it would appear that age and gender go hand in hand and are thus reported on together. The incidence rates tend to be greater in males than females up until ≥ 75 years of age in which female incidence becomes greater than that of males (Truelsen et al., 2006), but regardless of gender the WHO estimates that stroke rates increase exponentially with age (Tobias et al., 2006; Truelsen et al., 2006). Research in a developing country Das et al. (2007) found 20 individuals in his study group suffered a first time stroke before 40 years of age which leaves a rather conflicting picture of stroke regarding the age of onset. But again in a developed country, such as New Zealand, the average age of stroke onset is ≥ 65 years of age (Tobias et al., 2007), thus the state of the country regarding its development should also be factored in. It is often seen that age will also have an influence on the presence of modifiable risk factors (Lee et al., 2011). A study by Lee et al. (2011) found that these risk factors differed significantly between the age group ≤ 49 years and ≥ 50 years population, but these findings will be discussed in chapter 4.

Young et al. (2009) also found that individuals who are HIV positive are at a higher risk of developing diabetes. The processes identifying this relationship include (1) the pro-inflammatory process of HIV, (2) direct effects of ARV's and (3) the indirect outcomes of

ARV's. The most influential indirect consequence of ARV use appears to be body fat distribution changes (Young et al., 2009). Increased fat deposition in the muscles occur which leads to impaired insulin sensitivity. Antiretroviral regimens also impair glucose tolerance (Young et al., 2009). Wit et al. (2008) took a deeper look into the specific ARV's; they found that the relationship between the development of new-onset diabetes and the use of Stavudine was significant and Zidovudine and Didanosine appeared to increase one's likelihood of developing new-onset diabetes (Wit et al., 2008). Conversely exposure to Ritonavir and Nevirapine reduced one's risk of acquiring new-onset diabetes (Wit et al., 2008).

Diabetes is also considered a modifiable risk factor. A significant association between stroke prevalence and diabetes was noted by Burke and Venketasubramanian (2006),yet in knowing this, there is still a low percentage of appropriate primary preventative treatment for diabetes, even in developed countries (SpengosandVemmas, 2010). There appears to be no age discrepancy too as diabetes is a major risk factor for stroke in both young and old, but is seen more frequently in those ≥ 50 years of age and those of Asian and African decent (Lee et al., 2011). Turanjanin et al. (2011) specified that it was in fact diabetes type II that was seen as a major risk factor which becomes more so depending on the duration and presence of the disease, as well as if it is a co-morbid along with hypertension. Diabetes type II (formerly called non-insulin-dependent or adult-onset diabetes) is defined by the WHO (2013) as being caused by the body's ineffective use of insulin. It often results from excess body weight and physical inactivity. Diabetes is a lifestyle related disease and therefore cannot be discussed without looking at obesity and dyslipidaemia as modifiable risk factors.

Obesity and dyslipidaemia were reported as risk factors in a study by Bhalla et al. (2009). They recommended a cholesterol level of 200mg/dL for stroke prevention, but if it decreases below 180mg/dL there is a significant increase in risk of suffering a haemorrhagic stroke but the inverse, i.e. an increase in total cholesterol, increases the risk for an ischaemic stroke. Thus a very fine balance of the total cholesterol levels is extremely important. Dyslipidaemia was one of the most frequently found risk factors on

onset of ischaemic stroke at 41.1% (Spengos and Vemmas, 2010). Human immunodeficiency virus infection can be associated with accelerated large-vessel atherosclerosis, potentially caused by cART and associated metabolic complications i.e. dyslipidaemia(Benjamin et al., 2012).

A study by Bhalla et al. (2009) based in Nepal found smoking to be the greatest modifiable risk factor within their study group at 58.3% with alcohol consumption in third place at 41.4%. Smoking was again found as a major risk factor in Spengos and Vemmas (2010) study at 59.3%, the most frequent risk at stroke onset. Smoking is seen in both young and old (Lee et al., 2011). Cigarette smoking independently increases the relative risk of stroke by ± 3-fold, with a prevalence of smoking in young adults with stroke in recent western studies between 44 – 47% (Lee et al., 2011; Turanjanin et al., 2011). The Framingham study was referred to in Turanjanin et al. (2011) in which excessive but also moderate alcohol consumption in males is associated with an increase in relative risk of stroke. However, the consumption of small quantities is associated with a decrease in relative risk of stroke compared with those who do not drink at all (Turanjanin et al., 2011; Smith Jr et al., 2011). This could imply that a small quantity of alcohol is somewhat preventative against stroke incidence.

2.8 Impact of Stroke on the Individual and the Community

During the acute phase post stroke, the common impairments are motor function (50 – 83%), cognitive functioning (50%) urinary incontinence (40 – 50%), dysphagia (45%), aphasia (23%) and dysphasia (36%)(Paul et al., 2007). This is further compounded by the fact that approximately half of all surviving stroke patients make incomplete recovery and half of them will require assistance with their activities of daily living (Wasserman et al., 2009; Truelson et al., 2006).These impairments lead to inability to carry out activities of daily living and hence caregivers suffer high levels of emotional strain and distress from looking after the stroke survivors (Paul et al., 2007).

Stroke is a costly disease due to the nature of physical disability which often determines length of time in hospital (Wade and Hewer, 1987; Jongbloed, 1986). Wade and

Hewer(1987) performed a study in England focussing on the functional abilities of individuals post-stroke. The Barthel Activity of Daily Living Index was used as an outcome measure. A score of 20 implied functional independence but not necessarily normality. It must also be stressed that patients were scored on what they did and not their potential functional ability. A hierarchy amongst the tests was identified by Wade and Hewer (1987) i.e. at three weeks 50% of the patients that scored between one and nineteen could groom alone but only 14% could dress alone. They concluded that dressing unaided was one of the tasks that recovered relatively late in the rehabilitation process.

Deficits in the upper limb and lower limb function are the most debilitating and persistent impairments seen post-stroke (Chauhan and Kumar, 2012). Eighty percent of all stroke survivors have gross and fine motor impairments with general balance problems, leading to poor recovery of activities of daily living and mobility (Chauhan and Kumar, 2012).

Jongbloed (1986) identified predictors that differ between stroke patients with good and poor prognoses. Below is a summary of these predictors identified.

Table 2.5 Predictors of Stroke Prognosis

Predictor	**Outcome**
Age	Data favours that older individuals have less functional outcomes
Sex	No difference found
Previous stroke	Negative relationship between previous stroke and functional outcome
Urinary / Bowel incontinence	Adverse prognosis on functional outcome
Hemisphere of stroke	No difference found

(Jongbloed, 1986)

The above table provides a clear guideline from which one can foresee discharge outcomes when a stroke survivor's clinical characteristics are taken into account. A stroke survey by Wasserman et al. (2009) done in rural Kwa-Zulu Natal, South Africa,

found that upon discharge from hospital, 90% of the patients with stroke were bed or wheelchair bound (Wasserman et al., 2009). At the three month follow-up 55 % of the survivors were independently mobile compared to the 10% that were mobile on discharge. Most survivors did show some functional improvement, but their quality of life remained considerably impaired based on their self-assessment scores.

Galski et al. (1993) identified that major depression or dysthymic disorders occur in 20% - 63% of stroke survivors in the acute phase or rehabilitation, and this could hamper the rehabilitation process. Not only can one's mood become a challenge in recovery, but deficits in cognition could also negatively influence one's rehabilitation. Deficits in cognitive abilities such as abstract thinking, judgement, short-term verbal memory, comprehension and orientation might affect a patient's length of stay in the hospital and their functional status at discharge (Galski et al., 1993). A stroke survivor with cognitive deficiencies might not have the insight and capacity to learn new tasks and the ability to carry over functional skills from day-to-day. Thus a patient who excels in their physical rehabilitation may be less functional as a whole individual in their community due to cognitive disabilities that hold them back from interacting functionally in their community (Galski et al., 1993).

Individual burden is not the only consequence of stroke. On a societal level it is responsible for a large portion of health costs (Paul et al., 2007). A considerable portion of all costs to patients with stroke is due to long-term care, rehabilitation, nursing and loss of production (Truelson et al., 2006). Clearly the burden does not lie in high mortality alone, but the high morbidity of stroke leaving up to 50% of survivors chronically disabled (Myles and Breyer, 2006).This burden is compounded by the fact that South Africa has limited resources for stroke care and rehabilitation facilities, especially to those who cannot afford private medical services (Rigby et al., 2009; Wasserman et al., 2009).

2.9Rehabilitation Approach to Individuals withstroke and HIV/AIDS

The terms ‘multidisciplinary’ and ‘interdisciplinary’ are often mentioned when the rehabilitation of an individual who has suffered stroke is discussed. However there lies a great difference within the connotation of these terms. A sub-acute rehabilitation unit may consist of a ‘team’ made up of a multitude of differing professions but each working within their own scope of practice and not engaging together in approaching the case in a holistic manner (Norrefalk, 2003). Melvin (1980) further described ‘multidisciplinary’ as: “refers to activities that involve the efforts of individuals from a number of disciplines. These efforts are disciplinary-orientated and, although they may impinge upon clients or activities dealt with by other disciplines, they approach them primarily through each discipline relating to its own activities”.Whereas an ‘interdisciplinary’ team made up of many differing professionals communicate with one another on a regular basis to discuss a case and identify ways in which to assist each other and the patient in reaching their goals (Norrefalk, 2003). “Interdisciplinary team individuals do not only require the skills of their own disciplines, but also have the added responsibility of the group effort on behalf of the activity or client involved. This effort requires the skills necessary for effective group interaction and the knowledge of how to transfer integrated groups activities into a result, which is greater than the simple sum of the activities of each individual discipline. The group activity of an interdisciplinary team is synergistic, producing more than each individually and separately could accomplish” (Melvin, 1980). Fortunately the institution at which this study is based works on the basis of the latter approach and meet weekly to discuss each case in great detail and determine a means in which each team member, including the patient, can support one another in reaching the rehabilitation goals. In a study by Duncan et al. (2005) they confirmed that rehabilitation should be delivered in a coordinated and organised setting; therapy should be delivered by a variety of disciplines; and an organised team approach should also be continued in coordinating the out-patient or home-based rehabilitation care.

Rehabilitation is a vital component of post-stroke care with up to two-thirds of survivors requiring rehab (Chestnut, 2011). There is a growing need for identifying barriers to an

efficient rehab service (Chestnut, 2011), and effective rehabilitation initiated early after stroke can help enhance the recovery process and minimise functional disability (Chauhan and Kumar, 2012; Duncan et al.,2005). This early initiation is based on physiological findings in which the second week post-stroke involves softening of an infarct, subsiding of oedema and vasculargrowth around the infarct (Chestnut, 2011). Post-stroke rehabilitation can begin during acute hospitalisation, once the diagnosis of stroke has been made (Duncan et al., 2005). It is during this phase in which the highest priorities of care include: (1) prevent recurrent stroke and complications, (2) ensure proper management of general health functions, (3) mobilise the patient, (4) encourage the resumption of self-care activities and (5) provide emotional support to the family and patient (Duncan et al., 2005).

Recovery post-stroke can depend largely on type of stroke suffered and the existence of a co-morbid disease, and as previously discussed the effect of HIV on the body could hamper recovery severely (Chestnut, 2011). Putting HIV aside, the disabilities that transpire as a result of stroke can be devastating to the individual. Dobkin (2005) described these disabilities in one of his articles; approximately 35% of stroke survivors with initial paralysis of the effected leg do not regain useful function, 20 – 25% require full physical assistance to walk and ± 6 months post-stroke, 65% of stroke survivors cannot integrate the affected hand into usual activities. Finally, only 25% of stroke survivors return to the level of everyday participation and physical functioning of community matched individuals who have not suffered a stroke (Dobkin, 2005).

In-patient rehabilitation was found to be most effective when the patient had adequate cognition and fitness to participate in treatment for three hours a day (Duncan et al.,2005; Dobkin, 2005). Duncan et al. (2005) stated that a patient's tolerance for therapy will depend on several factors including severity of stroke, medical stability, mental status and level of function. Higher order cognitive skills such as short term memory, language, orientation, safety awareness, and judgement also play a major role in predicting a patient's functional status at discharge.We now, however, need to take into account that some stroke survivors live with the co-morbid disease of HIV – causing

its own host of impairments on the body. A lot of the deficits caused as a result of stroke become compounded by the co-existence of HIV. Dudgeon et al. (2006) described wasting syndrome which leaves the individual with chronic weakness and anaemia. The effect that HIV has on the gastrointestinal tract could lead to dehydration and thus the patient's condition is further weakened (Rusch et al., 2004).

As mentioned previously, the ideal candidate for rehabilitation is one that has sufficient cognitive and physical fitness to tolerate the rehabilitation programme. Unfortunately HIV further affects the individual's higher order cognitive skills by causing loss of concentration, distractibility and repetitive reminders (Moore et al., 2011; Ances et al., 2008). Dudgeon et al. (2006) found that the HIV infectedpopulation have a high incidence of anxiety and depression and this could result in reduced motivation and drive that would hold back the rehabilitation process.

Pain is also a very real and challenging symptom of HIV often resulting in painful sensory neuropathy and myopathy which, if not treated correctly, could lead to chronic pain and hamper participation in rehabilitation (Mochan et al., 2003). Lastly, the introduction of ARV's (which does have life-extending outcomes) can also have a negative impact on the patient. Rusch et al. (2004) confirmed that: 48.2% suffer from general weakness, 47% suffer from poor concentration and, 46.6% suffer from chronic fatigue. It is a vicious cycle.

During the post-stroke training period, gross motor function improves at a faster rate as compared to fine motor, suggesting fine motor skills require more time to recover (Chauhan and Kumar, 2012). Despite all the above mentioned challenges, one must venture forward and not be discouraged by the cognitive or physical impairments of the stroke survivor. Duncan et al. (2005) support early mobilisation of a patient in order to prevent skin breakdown, contractures, pneumonia and prevent the development of deep vein thrombosis (DVT). Other early interventions could include range of motion exercises and regular changes in the patients bed position if they are unable to do so themselves. Patient fatigue could be overcome by reducing treatment times but

increasing the number of treatment sessions per day. Duncan et al. (2005) also suggests that treatment sessions be task-orientated i.e. familiar to the patient or adapting the tasks to suit their cognitive needs in order to gain more function. Progressive aerobic exercise can also assist with patient lethargy and progressive resistance exercises for muscle strengthening can be included in daily treatment sessions, in order to address the resultant changes in muscle fibres and atrophy induced by non-use (Duncan et al. 2005).

Otherconventional therapies are used in stroke rehabilitation:Bobath, Neurodevelopmental therapy and Proprioceptive neuromuscular facilitation (Chauhan and Kumar, 2012). However, there is a need to involve motor control and motor learning by providing patient feedback. External rhythmic information provided by cue may reduce attentional load as it informs the motor system about temporal sequencing of a task, rather than needing to internally plan and prepare for the task (Chauhan and Kumar, 2012).

Hartigan (2012) views goal setting as being fundamental to the rehabilitation process. The challenge lies in developing patient-centred intensive rehabilitation programmes as well as with self-directed exercise and activity. It is important to note at this point that the main member of the rehabilitation team is in fact the patient and the process of goal-setting can enhance patient autonomy as they along with the therapists come to an agreement and understanding as to what their goals should be (Hartigan, 2012). The previous biomedical model used in rehabilitation falls short in this new concept as it does not view health as the individual's ability to interact with their environments and participate in desired activities, hence the need for a team approach in goal-setting (Hartigan, 2012). This is supported by a study done by Lund et al. (2011) in which stroke survivors often reported unmet needs relating to their own well-being, experiences of anxiety, depression, lack of meaningful activities and restrictions in social participation within their daily lives up to five years post-stroke.

Goal-setting is the process of dialogue and negotiation during which the patient and the

therapist determine the key rehabilitation goals found to be appropriate for that patient. This ‘patient-centred’ goal-setting is considered as ‘best practice’ in the rehabilitation setting (Hartigan, 2012).

It is well known that functional impairment upon admission to a rehabilitation unit can greatly influence a patient’s functional outcome (delPilar Torres-Arreola, 2009). However, ineffective rehabilitation outcomes occur when rehabilitation behaviours become unstructured, lack purpose and lack direction all of which can result when goals are not set in place. A strong, positive self-awareness will empower the patient to consciously and actively identify realistic goals (Hartigan, 2012).

2.10 Summary of Literature Review

The purpose of this study has been to determine whether an individual’s HIV status, after suffering a stroke, plays any role in their functional ability after a period of interdisciplinary rehabilitation intervention has been provided to the individual.The treatment of stroke requires specialised care and resources but unfortunately only 10 – 20% of the South African population has access to this. Despite the clinical picture of stroke one must not forget that there exists two distinct types of stroke, (1)ischaemic and (2)haemorrhagic. Research shows that ischaemic strokes occur more frequently in the general population but the same is also true for those individuals who are HIV positive and have suffered a stroke. The study done in Groote Schuur Hospital, Cape Town, South Africa ; identified 42% of HIV positive study participants’ first ever stroke was in fact the clinical event which resulted in their initial diagnosis of HIV. Risk factors for stroke differed between HIV-associated stroke and HIV negative stroke. HIV negative risk factors included hypertension, diabetes, hypercholesterolemia and smoking; whereas HIV-associated stroke risk factors was limited to mainly infections at 28%. Stroke in general will remain the second most common cause of mortality worldwide, according to the WHO 2020 projections. Gender plays a role regarding age of onset of stroke with females usually experiencing their first stroke 4.3 years after the male population.

Stroke alone has a devastating impact on the individual both physically and psychologically. Deficits in the upper limb and lower limb function are the most debilitating and persistent impairments seen post-stroke. Major depression or dysthymic disorders occur along with deficits in high order cognitive skills. This study has opened itself to research on not one disease but two, and whether their co-existence complicates the functional recovery of an individual who has suffered a stroke. HIV is a retrovirus or 'slow' virus as time from initial infection to appearance of clinical symptoms can take years. It is usually central nervous system abnormalities that are considered as first signs of infection i.e. stroke. This virus has similar effects on the body physically and psychologically as an individual who has suffered a stroke but who is HIV negative. Antiretroviral'sused to treat HIV unfortunately has a worsening effect of the symptoms. Over the past 3 years the number of new infections globally have fallen by 13%. However, Sub-Saharan Africa remains the most severely affected region with approximately one in every 20 adults living with HIV and this accounts for 71% of all individuals living with HIV worldwide.

CHAPTER 3

3. Methodology

3.1 Introduction

This chapter describes the type of study performed and the steps taken to follow it through. Analysis of data retrieved is also explained in this chapter.

3.2 Study design

This was a retrospective longitudinal study utilising the review of subject records.

3.3 Setting

The subjects for the study were drawn from Witrand rehabilitation unit in the North-West province of South Africa. The North-West Province is found central north of South Africa and is completely landlocked, making up 0.5% of the total land area of the country(Jacobs et al.,2009) The North-West is reported as being one of the poorer provinces in South Africa. In the 2001 census 20% of the population that was ≥ 20 years old had no formal schooling(Jacobs et al.,2009). It is estimated that 69% of all households in the province lived in formal dwellings; 22% in informal structures and 5% in traditional structures (Jacobs et al., 2009).

Witrand hospital, based in Potchefstroom, consists of 12 wards. Three of which are specialised: Emergency Unit, Rehabilitation Unit and the Psychiatric unit. The other nine wards serve as housing for those individuals who are intellectually and physically disabledwhose families are unable to care for them. The psychiatric and rehabilitation units serve the whole of the North-West province, as they are the only specialised units of their kind in the province. However, a majority of admissions tend to come from within the Dr Kenneth Kaunda District.The rehabilitation unit requests permission from all patients admitted to test for HIV. If the individual is unable to provide reliable consent then the

family is asked. If permission is granted, the patient undergoes pre-test counselling followed by post-test counselling. Information regarding the rehabilitation unit was obtained during a personal conversation with Miss J van der Linde, case manager of the rehabilitation unit, March 2010.

3.4 Sample Selection and Size

All subjects' files dating back to 21 April 2005, the opening of the unit, to December 2010 were analysed. There were 570 admissions to the unit during this time period of which 141 were stroke survivors that met the study's inclusion criteria. The researcher reviewed all files and identified those relating to patients with stroke. These were then audited. Participants for the study were selected using the following criteria:

3.4.1. Inclusion criteria:

- First incident stroke survivors who were admitted to the Witrand rehabilitation unit in the North-West province between 2005 and 2010.
- Subjects of all ages with stroke admitted during the specified period.
- Subjects who were admitted and had a confirmed diagnosis of stroke.
- Subjects with stroke whose functional ability was well documented using the SADFM (β – measurement tool) from admission to discharge.

3.4.2 Exclusion criteria

- Stroke survivors in which HIV status was undetermined and functional recovery was not determined using the SADFM (β – measurement tool).
- Subjects with second time stroke.

3.5 Procedure

3.5.1Ethical considerations

- Ethical clearance was granted by the Human Research Ethics Committee (Medical) for the University of the Witwatersrand. Clearance numberM110493(See Appendix A).
- Participant confidentiality was ensured at all times during data collection by not writing patient names on the data collection forms and ensuring the coding sheet was destroyed at the end of the study.
- File numbers were used on the coding sheets to maintain confidentiality

3.5.2 Pilot Study

A pilot study was done prior to the main study. The aim of the pilot study was to determine whether the self–designed questionnaire was effective in the collection of appropriate data required for the study.

3.5.2.1 Objectives of the Pilot Study

- To determine if the questionnaire captured sufficient demographic and clinical information of the study group as well as the change in their functional abilities to fulfil the main objectives of the study
- To obtain a basic understanding of the stroke population demographics.

3.5.2.2 Methodology of the Pilot Study

The pilot study was done through review of participant records.Ten files of patients with stroke were randomly drawn from the many files of patients with stroke admitted to the unit between21 April 2005 (the opening of the unit)and December 2010.

Subjects were included or excluded into the pilot study using the criteria set for the main study. The pilot study was done after obtaining permission from the hospital authorities. Data were captured using the data collection sheet and compiled into HIV positive and HIV negative profile groups.

3.5.2.3 Results of Pilot Study

Of the 10 files selected, six fulfilled the inclusion criteria. Five of these files were of participants who were HIV negative and one was HIV positive. In order to develop an HIV negative group profile, the mean of the data collected was used. Below is a table reflecting the findings.

Table 3.1: Results of the pilot study

HIV POSITIVE PROFILE (n = 1)	**HIV NEGATIVE PROFILE (n = 5)**
Age: 42 years	**Mean age:** 51.2 years
Weight on admission: 63.6kg	**Mean weight on admission:** 64.62kg
β – Score on admission: 26 / 126	**Mean score on admission:** 56.6 / 126
β – Score on discharge: 54 / 126	**Mean score on discharge:** 85.2 / 126
Points gained: 28	**Mean points gained:** 28.6
Length of stay: 49 days	**Mean length of stay:** 17.8 days
Risk factors: None	**Risk factors:** 5had hypertension

3.5.2.4 Discussion and conclusion of pilot study results

From these results it was clear that despite gaining on average the same number of points, it took the HIV positive individual 31 days longer to achieve this. In general the rest of the data did not differ significantly. The questionnaire was successful in collecting all the relevant data needed to fulfil the main objectives of the study, and thus required no further editing. Though only one individual was HIV positive from the reviewed files, the researcher's experience from working at the hospital showed that there would be enough individuals for the main study.

3.5.3 Main Study

Ethical clearance was sought from and granted by the University of the Witwatersrand Human Research Ethics Committee (Medical)to perform the study. Permission to use hospital patient records in the study was also requested for and granted (AppendixB). Data collection from the hospital archives was done using self-designed data collection

sheets(AppendixC). In order to ensure confidentiality of data, the data collection sheets were coded using a random coding system of one alphabet letter linked with a number i.e. A1; A2 etc.A research assistant aided in drawing the archived stroke files but did not capture any data from said files to further ensure confidentiality.Data were collected from all the files of individuals who had suffered a stroke between 2005 and 2010.This time period was chosen because the rehabilitation unit was using the β assessment tool to keep record of patient progress at the time. Over this five year period, 173 individuals suffering from stroke were treated at the Witrand Rehabilitation Unit. However, 32 patient files did not meet the inclusion criteria thus leaving a study group of 141 patient files. Information was captured from these files and was then analysed.

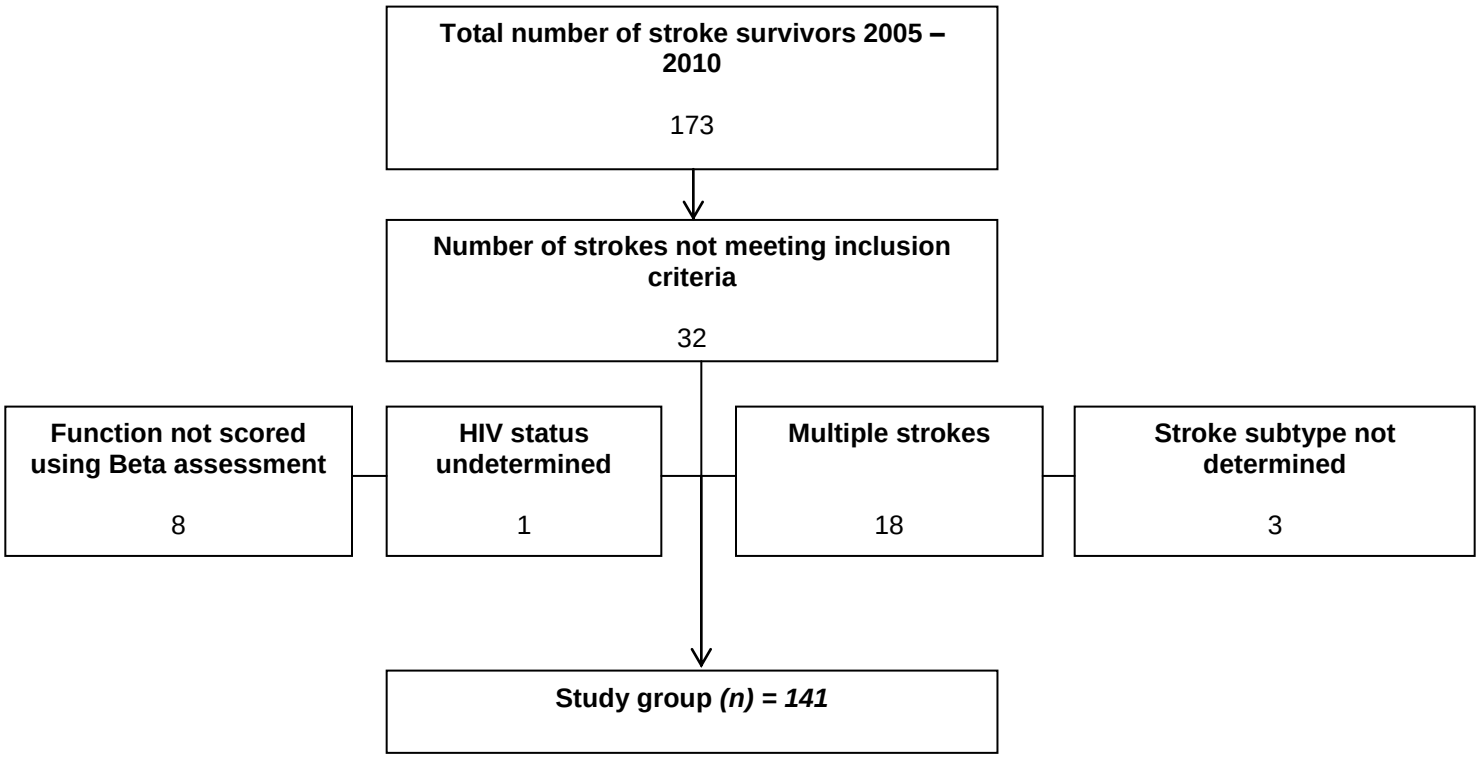


Figure 3.1 Study Group

3.6Instrumentation and Outcome Measures

a) The South African Database for Functional Medicine (Beta assessment tool)

The South African Database for Functional Medicine (Beta assessment tool) was used to determine patients' functional ability (AppendixE). The β – score assessment tool is one of three platform level tools designed by the South African Database for Functional Medicine (SADFM).It allows the assessor to monitor a patient's progress as it is reported on a weekly basis(www.sadfm.co.za, 2010). It also allows for developmental research into health care outcomes.It is based on the well-known American version, the Functional Independence Measure. This tool works within the World Health Organisation framework of the International Classification of Function, Disability and Health (www.sadfm.co.za, 2010).

The β – score assessment tool can be used in sub-acute settings where one can compare the difference between admission and discharge scores of patients to determine improvement in functional abilities(www.sadfm.co.za, 2010). It is an evidence – based scoring system which can convert a patient's functional abilities and behaviour into quantifiable data. Patients are scored by a multi-professional team, covering 18 areas with points given between one and seven. Thirteen of the items are physical domains and five are cognition items. In order to score the patient, therapists require an hour of training and should pass a written exam in order to be qualified to use this measurement tool (www.sadfm.co.za, 2010). Functional ability is assessed on the basis of direct observation.

The patient is scored on what they actually do on a daily basis and not on what they could do (www.sadfm.co.za, 2010). If the patient's performance varies from day to day the therapist must score them on their lowest performance score. Areas assessed include: Eating; Grooming; Bathing; Dressing upper body; Dressing lower body; Toileting; Bladder management; Bowel management; Transfers: Bed, chair, wheelchair; Transfers: Toilet; Transfers: Tub, shower; Locomotion: Walking, wheelchair; Locomotion: Stairs; Comprehension; Expression; Social interaction; Problem Solving

and Memory (www.sadfm.co.za, 2010).As mentioned before the patient is scored using a point system from 1 to 7. Below is a table explaining the definition for each point:

Table 3.2: The Beta Scoring System

Score	Definition
1	The subject does not assist at all. They are completely dependent on 1 or 2 therapists to complete the task.
2	The subject tries to assist, but provides less than half of the effort (25 – 49%). 1 therapist is required to complete the task.
3	The subject performs 50 – 75% of the task but still requires the help from 1 therapist.
4	The subject requires incidental hands on help only. They perform > 75% of the task.
5	The subject requires supervision, cuing and/or setting-up to complete the task.
6	The subject requires extra time or used an assistive device.
7	The subject is fully independent.

(www.sadfm.co.za, 2010)

The higher the β – score, the greater the functional ability. A normal score for a fully functional individual is 126/126(www.sadfm.co.za, 2010). The β – score tool was chosen due to its convenience as well as high reliability as evidenced by it'sCronbach's Alpha coefficient which showed that it had a "high to very high" internal consistency (www.sadfm.co.za, 2010). On admission the internal consistency was calculated as high as 0.96 and 0.98 on discharge scores (www.sadfm.co.za, 2010). Results from a Rasch analysis for construct validity are not yet available.

b) Demographic Questionnaire

The patient's demographic information and clinical characteristics was captured using a self-designed questionnaire (AppendixC). The information captured included age, gender, weight, race, hospital length of stay, number of strokes patient had, stroke subtype, co-morbidities present, date of admission, date of discharge, date of stroke, HIV status and whether they were receiving ARV's and their latest CD4 count.

3.7 Data Analysis

For data analyses, the various variables were categorised as follows:

Table 3.7.1 Data variables

Independent Variables		**Dependent Variable**
Categorical Variables	**Continuous Variables**	
- Gender - HIV status - ARV's - Race - Hypertension - Diabetes Mellitis - Cholesterol - Stroke sub-type - Type of rehabilitation received	- Age - CD4 count - Hospital length of stay - Weight - ARV treatment regime duration - Stroke duration	- Functional status

For data analysis the p-value was set at $p \leq 0.05$ with the confidence interval set at 95%. The data collected from the study group (n = 141) was first analysed using descriptive statistical tests to describe the group demographics and clinical characteristics. Categorical data was summarised as numbers and percentages and continuous data was summarised as means and standard deviations. A two sample t-test was used to compare mean admission and discharge functional scores between the HIV negative and HIV positive patients and to compare the functional change in ability of patients who were HIV positive and those who were HIV negative on discharge.

CHAPTER 4

4. RESULTS

4.1 Introduction

The objectives of this study were:1) To describe the group demographics and clinical characteristics of patients admitted to the Witrand rehabilitation unit, 2) To establish and compare the functional abilities of patients who are HIV positive with those who are HIV negative on admission to the Witrand rehabilitation unit, 3) To establish and compare the functional abilities of patients who are HIV positive with those who are HIV negative on discharge from the Witrand rehabilitation unit and 4) To compare the functional change in ability of patients who are HIV positive and those who are HIV negative on discharge from the Witrand rehabilitation unit.

Study participants' demographics and clinical characteristics are described using the data collected using the demographic questionnaire. The β-scores results arepresented to indicate functional ability of the stroke survivors which allowed comparisons between the admission and discharge scores of the two groups, i.e. patients with stroke who were HIV positive and negative.

4.2 Demographics and clinical characteristics of the study group

Figure 4.1 below provides a description of the study group's gender, HIV status and CD4 count.

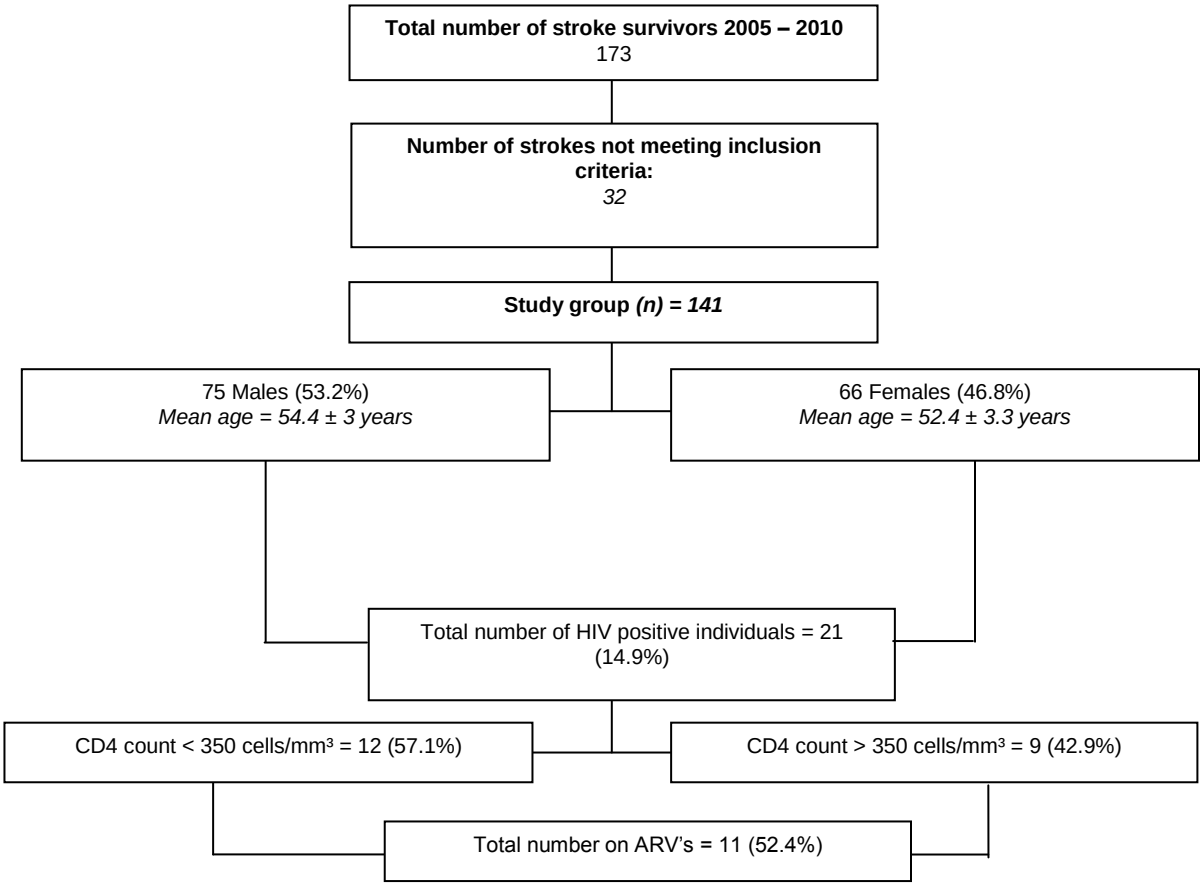


Figure 4.1: Study group's gender, HIV status and CD4 count

From the year 2005 to 2010, 173 stroke survivors were admitted to the Witrand rehabilitation unit. From this total, 32 patient files were excluded for not meeting the inclusion criteria and hence data from 141 files were used for the study (n). There were 75 (53.2%) male and 66 (46.8%) female stroke survivors. The mean age for the patients with stroke was 54.4 ± 3years for male and 52.4±3.3 years for female stroke survivors. About 57% of those patients with stroke who were HIV positive had a CD4 count below 350cells/mm^3.

The demographic details and clinical characteristics of the categorical variables of the study group are shown in Table 4.1 below.

Table 4.1: Study group demographics and clinical characteristics: Categorical variables

	HIV Positive **n = 21 (14.9%)** **n(%)**	**HIV Negative** **n = 120 (85.1%)** **n(%)**	**Total** **n = 141 (100%)** **n(%)**
Gender			
Male	8 (38.1)	67 (55.8)	75 (53.2)
Female	13 (61.9)	53 (44.2)	66 (46.8)
Race			
African	21 (100.0)	80 (66.7)	101(71.6)
Caucasian	0 (0.0)	33 (27.5)	33 (23.4)
Coloured	0 (0.0)	6 (5.0)	6 (4.3)
Indian	0 (0.0)	1 (0.9)	1 (0.7)
Subtype			
Ischaemic	20 (95.2)	85 (70.8)	105 (74.5)
Haemorrhagic	1 (4.8)	35 (29.2)	36 (25.5)
Hypertension	8 (34.8)	37 (31.4)	45 (31.9)
Diabetes	2 (9.5)	7 (5.8)	9 (6.4)
Cholesterol	2 (9.5)	6 (5.0)	8 (5.7)
Treatment received: Medical Officer, Physiotherapist, Occupational therapist, Clinical Psychologist, Dietician and Nursing	21 (100.0)	120 (100.0)	141 (100.0)

All the patients who were HIV positive were of African descent and they also had the greatest number of admissions (71.6%) to the rehabilitation unit over the period 2005 – 2010. Ischaemic strokes were more prevalent than haemorrhagic strokes (74.5% and 25.5% respectively) and hypertension (31.9%) was the most common stroke risk factor.

The demographic details and clinical characteristics of the continuous variables of the study group are shown in Table 4.2 below.

Table 4.2: Study group demographics and clinical characteristics: Continuous variables

	HIV Positive n = 21(14.9%)	**HIV Negative n = 120 (85.1%)**	**Total n = 141 (100%)**
	Mean (SD)	**Mean (SD)**	**Mean (SD)**
Age (Years)	39.6 (±10.8)	54.9 (±13.6)	52.7 (±14.3)
Length of Stay (Days)	30.5 (±8.8)	38 (±15.6)	36.9 (±15.1)
Weight (Kg)	58.4(±16.3)	67.1 (±16.8)	65.8 (±17.0)
Stroke duration prior to admission to Witrand hospital (days)	26.2 (±14.4)	25.7 (±24.0)	25.8 (±22.7)

There was a discrepancy in age of stroke onset between those individuals with HIV and those without HIV. The age of stroke onset in the HIV positive group is on average ± 15 years earlier than those individuals who are HIV negative. The HIV negative group appears to require approximately

a week longer of rehabilitation intervention. Both groups began their rehabilitation at approximately the same time period after stroke onset. Information regarding the ARV treatment regimens patients were on during their stay in hospital was insufficient and thus no meaningful data could be obtained from this study sample.

4.3 Functional abilities of patients on admission and at discharge

The patient functional abilities were measured using beta scores. Results of the functional abilities of the study group on admission, on at discharge and the change in functional ability fromadmission to discharge are shown in Table 4.3 below.

Table 4.3: Patient functional ability represented by mean Beta scores

	HIV positive (n =21)	**HIV negative** (n = 120)	
	Mean Beta score/126(SD)	**Mean Beta score/126**(SD)	**p-value**
Beta scores on admission	56 (±21)	60 (±25)	0.53
Beta scores at discharge	96 (±28)	97 (±23)	0.60
Mean Beta scores change from admission to discharge	40 (±19)	38 (±20)	0.88

SD = Standard deviation

The mean beta scores of the two groups on admission and discharge were not statistically significant. The mean change differences in beta scores between the two groups were also not statistically significant.

CHAPTER 5

5. Discussion

5.1 Introduction

This chapter serves to further study and discuss the results obtained in this study. Comparisons of results will also be made and discussed based on literature reviewed in Chapter 2. Results obtained will be discussed under the following subheadings: Study group's gender, age, HIV status, CD4 count, length of stay (L.O.S) and stroke duration; Study group clinical characteristics; Functional abilities of study participants and Limitations of the study.

5.2 Study group's gender, age, HIV status, CD4 count, L.O.S and stroke duration

There were more male stroke patients (53%) in this study group which resulted in a male to female ratio of 1.1:1. This finding is almost similar to that by Mochan et al's(2003) study in which stroke was found in participants with a male to female ratio of 1.5:1. However, results of this study showed that within the HIV positive group more females appeared to be affected by stroke than males (13 females to 8 males) with a male to female ratio of 1:1.6. Stroke affects males at an earlier age than females within the general population, with females having stroke approximately 4.3 years later than men(Appelros, 2009). In this study, however, there was no difference in age of stroke onset, with male's average age of onset being 54.4 years and females 52.4 years. The greater number of females with HIV could stem from the fact that there are more females with HIV infection than males in sub-Saharan Africa (Glynn et al., 2001). In several areas in Sub-Saharan Africa it was noted that there existed a greater prevalence of HIV in young women, possibly as a result of greater exposer to infected partners, or due to their higher risk of acquiring HIV from an infected partner (Glynn et al, 2001).

Of those individuals suffering from HIV, 12 individuals (57%) had a CD4 count of <350 cells/mm^3. In South Africa, antiretrovirals are administered once an individual's CD4 count is ≤ 350 cells/mm^3(South African Antiretroviral Treatment Guidelines, 2013).Thus it is important to note that 11 individuals of the study group were receiving ARVs. It can therefore extrapolated that possibly the public health sector is implementing this treatment protocol effectively. The introduction of ARV's into one's treatment regimen has the potential to improve one's CD4 count which could further prevent the development or onset of other diseases, lessening the

health burden to a degree(Lemogoum et al., 2005).

There is a considerable difference in age of stroke onset when comparing the individuals who were HIV positive with those who were HIV negative. The mean age of stroke onset for an individual with HIV was 39.6(±10.8) years, whereas the mean age of stroke onset for individuals that did not have HIV was 54.9(±13.6)years. In a study by Lemogoum et al. (2005) it was noted that stroke generally affected a younger population in developing countries compared to developed countries. Tobias et al. (2007) found that the average male onset of stroke was 68.9 years and 73.3 years for females, with males having ± 20% higher prevalence rate than that of females, supporting the older onset of stroke in the Western world (Tobias et al., 2007). It should be noted that the average age of stroke onset is 54.9 years in the HIV negative group, approximately 14 and 18 years earlier than the average age of stroke onset in males and females in the Western world respectively. Stroke can no longer be considered an 'old-age' disease in developing countries.

5.3 Study group clinical characteristics

The two subtypes of stroke appear in both clinical groups,i.e. the HIV positive and HIV negative individuals. In keeping with the literature, ischaemic strokes were more common than haemorrhagic strokes, with a ratio of 3:1(Lee et al., 2011; Turanjanin et al., 2011; Spengos and Vemmos, 2010; Appelros et al., 2009; Cabral et al., 2009; Benjamin et al., 2012). The risk for an ischaemic stroke is a further 3-4 fold greater in individuals with hypertension which is important when one considers the importance of hypertension as a stroke risk factor (Turanjanin et al., 2011). Lemogoum et al. (2005) found that despite cerebral haemorrhage being a leading cause of stroke fatality in Sub-Saharan Africa, cerebral infarction occurred more often. Regarding risk factors for stroke, hypertension far exceeded the others, affecting 34.8% in the HIV positive group and 31.4% in HIV negative group. Rigby et al. (2009) found hypertension to affect 80% of the stroke survivors in their study. Despite the vast difference in numbers within each of the study groups, this study confirmed this trend. Hypertension is the most consistent and powerful predictor of stroke and is involved in approximately 70% of all strokesLemogoum et al. (2005). Treatment of hypertension has the potential to reduce stroke risk by 35% - 40%, yet surveys still indicate poor control of hypertension in Africa (Lemogoum et al., 2005). Therefore, public education and awareness on stroke risk factors would greatly assist in lessening the social and economic burden of stroke.

Diabetes affected 9.5% of individuals with HIV as opposed to 5.8% of individuals without HIV. This validates Young et al's (2009) findings in which it was stated that individuals with HIV were at a higher risk of developing diabetes. The rapid leap towards urbanisation in Sub-Saharan Africa has been argued to lead to a rise in the prevalence of diabetes and other cardiovascular diseases (Mbanya et al., 2010).

This study found that HIV positive individuals stayed at the hospital on average 30.5(±8.8) days, whereas HIV negative individuals stayed for an average 38(±15.6) days. This discrepancy could be a result of the notably younger HIV positive group in this study. It could be argued that the advantage of age on recovery in this groupcould result in gaining, on average, a similar number of points on the beta scale with those individuals without HIV. It must be mentioned that this gain in points also occurred over a shorter time period. Thus one could reason that age was the determining factor in the more efficient positive outcome. However, when looking at the bigger picture, a younger population of individuals are being affected by stroke as a result of their HIV status. This could result in the growth of a younger 'disabled' population possibly resulting in an increase in the applications for disability grants. If younger individuals are not working one could assume a negative effect on our work force and labour if return to work is not possible.

5.4Functional abilities of study group

a) On admission

Functional ability was determined by the individual's beta score out of 126. Both HIV positive and HIV negative individuals were admitted at approximately the same amount of time post-stroke, 26.2 and 25.7 days respectively. This could have contributed to some extent to the little differences noted in functional ability between the two groups.

The mean beta scores for individuals with HIV was 56 points and for individuals without HIV was 60 at admission. The recovery of motor function has been documented to occur most effectively during the first month post-stroke, allowing for the improvement of motor deficits (Schaechter, 2004; Rossini et al., 2003; Hendricks et al., 2002).In both groups the rehabilitation process was allowed to begin at approximately the same period of time post- incident. Functional recovery is influenced by an array of biological and environmental factors (Hendricks

et al., 2002). Allowing for rehabilitation to occur at a similar time frame post-incident eliminates any bias towards a specific group.

Age at stroke onset appeared to be the greatest variance between the HIV negative group and the HIV positive group. This is more than likely as a result of the age of the group most at risk of developing HIV (Benjamin et al., 2012). Prior to their commencement of rehabilitation it should be taken into account that neurological recovery requires a degree of brain reorganization and that with age comes a certain degree of neuronal loss (Teasell et al., 2005). Neuroplasticity is the ability of the central nervous system to respond to internal and external stimuli by reorganizing its structure, function and connections (Cramer et al., 2011). Normal ageing is associated with a decline in and reduced plasticity (Cramer et al., 2011). These negative changes can be experienced as reductions in processing speed, working memory and peripheral nervous system functions; all of which can be associated with poorer rehabilitation outcomes (Cramer et al., 2011). Consequently one should expect adissimilarity in the two group's performance and ability to rehabilitate.

Ischaemic stroke subtype proved more common in the study group as a whole, as well as within each of the clinical groups. This is supported by literature from Lee et al., 2011;Turanjanin et al., 2011; Spengos and Vemmos, 2010; Appelros et al., 2009; Cabral et al., 2009. The global use of cART in HIV positive patients increases life expectancy and thus their risk for an ischaemic stroke due to its high correlation with age (Obviagele and Nath, 2011). In this study 11 of the 12 patients whose CD4 count was ≤350cells/mm^3 were receiving ARVs.

b) Rehabilitation and function at discharge from hospital

After receiving rehabilitation from a multidisciplinary team, the HIV positive group was discharged with a mean functional score of 96 points and the HIV negative group on 97 points. Studies evaluating the efficacy of post-stroke rehabilitation across different settings will find inconsistencies in the day-to-day treatment of patients (Schaechter, 2004). In this study that was minimised by exposing all stroke survivors to the same time period and level of treatment intensity on a daily basis. It is also important to note that some functional recovery does occur spontaneously as a result of the resolution of oedema in the brain, as well as possible recovery of tissue function in tissues that were ischaemic but not destroyed (Hallet, 2001).Despite the negative effects that HIV and ARV's have on the body and its physical performance, the use of

cART to achieve immune restoration is effective (Tan et al., 2012). Therefore the fact that a younger population of individuals suffered HIV but were being treated with ARV's allowed relatively stronger individuals to approach the rehabilitation process with more energy and better muscle strength (Greig et al., 1994).

During their stay the individuals with HIV improved with an average of 40 points and the individuals without HIV by 38 points. This change in score appears similar for both groups but the individuals with HIV took on average 8 days longer to achieve this increase in points. Again age could be considered as the deciding factor when trying to understand this difference in length of stay. Neural plasticity is crucial for functional recovery and this occurs more effectively and efficiently in younger individuals (Voytek et al., 2010).

When performing the various t-tests there were, in fact, no significant differences between the two different clinical groups.

5.5. Limitations

The small group of HIV positive individuals in this study did not provide sufficient power against the HIV negative individuals when performing the statistical analysis, yielding results that were not statistically significant. The vast difference in numbers of the two groups had an influence on the generalizability of the results of this study. Challenges to a study of this nature include therapist consistency over the five years. Eventhough therapists are trained in scoring the patients on the outcome measure and write an examination to be given permission to use the tool, therapist observations of the patients whilst scoring remains subjective. Thus certain patients may be scored more conservatively than others. It should be noted that blinding of the principle investigator was not necessary as data was collected after the five year period (2005-2010). The study wasalso limited to individuals admitted to only one hospital and thus again a similar study using a larger study group would provide more definitive results.It should also be noted that demographical information captured was specific to age and gender; a more extensive demographical profile should be created in future studies.

CHAPTER 6

6. Conclusion and recommendations

6.1Conclusion

Despite the statistically insignificant findings when comparing the HIV positive and HIV negative group functional outcomes, when taking a closer look at the study group's demographics and clinical characteristics, this study yielded interesting results.

There were more male stroke patients (53%) in this study group which resulted in a male to female ratio of 1.1:1. However, results of this study showed that within the HIV positive group more females appeared to be affected by stroke than males (13 females to 8 males) with a male to female ratio of 1:1.6. There is a considerable difference in age of stroke onset when comparing the individuals who were HIV positive with those who were HIV negative. The mean age of stroke onset for anindividual with HIV was 39.6 years, whereas the mean age of stroke onset for individuals that did not have HIV was 54.9 years. The African race was also more severely affected by stroke than any other.

In both groups the rehabilitation process was allowed to begin at approximately the same amount of time post- incident. As a result, both groups did not differ significantly on admission in terms of functional ability. The mean beta scores for individuals with HIV was 56 points and for individuals without HIV was 60.

After receiving rehabilitation from a multidisciplinary team, the HIV positive group was discharged with a mean functional score of 96 points and the HIV negative group on 97 points. As mentioned before, group age is the key to a positive outcome.

Thus during their stay the individuals with HIV improved with an average of 40 points and the individuals without HIV by 38 points. However this improvement in scores was achieved over different time periods. The younger HIV positive group achieved their increase in score over a period that was 7.5 days shorter than individuals in the HIV negative group.

6.2 Recommendations

This small group of HIV positive individuals in this study did not provide sufficient power against the HIV negative individuals when performing the statistical analysis, yielding results that were not statistically significant. The same study should be performed using a larger sample size and particularly one in which the individuals in the two groups are closer in sample size; thus providing the statistical power to provide a more definitive study result.

We can infer from these findings that patients who sustain stroke, are HIV positive, are receiving ARVs and rehabilitation treatment, can recover to the same level as those who are HIV negative within a similar amount of stay in a rehabilitation hospital. We can therefore argue that patients with stroke who are HIV positive should receive ‘normal’ rehabilitation like any other stroke patient.

References

1. Ances, B. M. & Clifford, D. B. 2008. HIV-associated neurocognitive disorders and the impact of combination antiretroviral therapies. Current Neurology & Neuroscience Reports. 8: 455 – 461.

2. Appelros, P., Stegmayr, B. &Terent, A. 2009. Sex differences in stroke epidemiology: A systematic review. Stroke. 40: 1082 – 1090.

3. Bagg, S., Pombo, A. P. &Hopman, W. 2002. Effect of age on functional outcomes after stroke rehabilitation. Stroke. 33: 179.

4. Benjamin, L. A., Bryer, A., Emsley, H. C. A., Khoo, S., Solomon, T. & Connor, M. D. 2012. HIV infection and stroke: Current perspectives and future directions. The Lancet (Neurology). 11: 878 – 890.

5. Bhalla, D., Marin, B. &Preux, P. M. 2009. Stroke profile in Afghanistan and Nepal. Neurology Asia. 14 (2): 87 – 94.

6. Burke, T. A. &Venketasubramanian, R. N. 2006. The epidemiology of stroke in the East Asian region: a literature-based review. International Journal of Stroke. 1: 208 – 215.

7. Cabral, N. L., Fonseca, L. A. M., Eluf-Neto, J., Gonçalves, A. R. R., Longo, A. L., Moro, C. H. C., Costa, G. &Amora, C. H. 2009. Incidence of stroke subtypes, progmosis and prevalence of risk factors in Joinville, Brazil: a 2 year community-based study. Journal of Neurology, Neurosurgery & Psychiatry. 80: 755 – 761.

8. Cadilhac, D. A., Dewey, H. M.,Vos, T., Carter, R. & Thrift, A. G. 2010. The health loss from ischemic stroke and intracerebalhemorrhage: Evidence from North-East Melbourne stroke incidence study (NEMESIS). Health Quality of Life Outcomes. 8: 49.

9. Canto-Brito, C., Majersik, J. J., Sanchez, B. N., Ruano, A., Becerra-Mendoza, D., Wing, J. J. & Morgenstern L. B. 2011. Door-to-door capture of incident and prevalent stroke cases in Durango, Mexico: the Brain Attack surveillance in Durango study. Stroke. 42 (3): 601 – 606.

10. Carod-Artal, F., Gonzalez-Gutierrez, J., Herrero, J., Horan, T. & De Seijas, E. 2002. Functional recovery and instrumental activities of daily living: follow-up 1-year after treatment in a stroke unit. Brain Injury. 16(3): 207 – 216.

11. Chestnut, T. J. 2011. Fatigue in stroke rehabilitation patients: A pilot study. Physiotherapy Research International. 16: 151 – 158.

12. Chouhan, S. & Kumar, S. 2012. Comparing the effects of rhythmic auditory cueing and visual cueing in acute hemiparetic stroke. International Journal of Therapy and Rehabilitaion. 19 (6): 344 – 351.

13. Connor, M.D., Thorogood. M., Casserly, B., Dobson., C. &Warlow, M. D. 2004. Prevalence of stroke survivors in rural South Africa. Results from the Southern Africa stroke prevention initiative (SASPI) Agincourt field site. Stroke. 35: 627 – 632.

14. Connor, M. D., Modi, G. &Warlow, C. P. 2009. Differences in the nature of stroke in a multi-ethnic urban South African population: The Johannesburg hospital stroke register. Stroke. 40: 355 – 362.

15. Cramer, S. C., Sur, M., Dobkin, B. H., O'Brien, C., Sanger, T. D., Trojanowski, J. Q., Rumsey, J. M., Hicks, R., Cameron, J., Chen, D., Chen W. G., Cohen, L. G., de Charms, C., Duffy, C. J., Eden, G. F., Fetz, E. E., Filart, R., Freund, M., Grant, S. J., Haber, S., Kalivas, P. W., Kolb, B., Kramer, A. F., Lynch, M., Mayberg, H. S., McQuillen, P. S., Nitkin, R., Pascual-Leone, A., Reuter-Lorenz, P., Schiff, N., Sharma, A., Shekim, L., Stryker, M., Sullivan, E. V. &Vinogradov, S. 2011. Harnessing neuroplasticity for clinical applications. Brain. 134 : 1591 – 1609.

16. Das, S. K., Banerjee, T. K., Biswas, A., Roy, T., Raut, D. K., Mukherjee, C. S., Chaudhuri, A., Hazra, A. & Roy, J. 2007. A prospective community-based study of stroke in Kolkata, India. Stroke. 38: 906 – 910.

17. De Wit, S., Sabin, C. A., Weber, R., Westring, S., Reiss, P., Cazanave, C., El Sadr, W., D'ArminioMonforte, A., Fontas, E., Law, M. G., Friis-Møller, N. and Phillips, A. 2008. Incidence and risk factors for new-onset diabetes in HIV-infected patients. Diabetes Care. 31: 1224 – 1229.

18. Dearborn, J. L. & McCullough, L. D. 2009. Perception of risk and knowledge of risk factors in women at high risk for stroke. Stroke. 40: 1181 – 1186.

19. delPilar-Torres, L., Doubova, S. V., Hernandez, S. F., Torres-Valdez, L. E., Constatino – Casas, N. P., Garcia – Contreras, F. & Torres-Castro, S. 2009. Effectiveness of two rehabilitation strategies provided by nurses for stroke patients in Mexico. Journal of Clinical Nursing. 18: 2993 – 3002.

20. Dobkin, B. H. 2005. Rehabilitation after stroke. New England Journal of Medicine. 352: 1677 – 1684.

21. Dudgeon, W., Phillips, K. D., Carson, J. A., Brewer, R. B., Durstein, J. L. & Hand, G. A. 2006. Counteracting muscle wasting in HIV-infected individuals. HIV Medicine. 7:299 – 310.

22. Dudgeon, W., Phillips, K., Bopp, C. & Hand, G. 2004. Physiological effects of exercise interventions in HIV disease. AIDS Patient Care & STD's. 18(2):81 – 98.

23. Duncan, P. W., Zorowitz, R., Bates, B., Choi, J. Y., Glasberg, J. J., Graham, G. D., Katz, R. C., Lamberty, K. &Reker, D. 2005. Management of adult stroke rehabilitation care: A clinical practice guideline. Stroke. 36: 100 -143.

24. Ellis, R. J., Calero, P. &Stockin, M. D. 2009. HIV infection and the CNS: A primer. Neuropsychology Review. 19: 144 – 151.

25. Fang, Y., Chen, X., Li, H., Lin, J., Huang, R. & Zeng, J. 2003. A study on additional early physiotherapy after stroke and factors affecting functional recovery. Clinical Rehabilitation. 17: 608 – 617.

26. Foley, J., Ettenhofer, M., Wright, M. J., Siddiqi, I., Choi, M., Thames, A. D., Mason, K., Castellon, S. &Hinkin, C. H. 2010. Neurocognitive functioning in HIV-1 infection: Effects of cerebrovascular risk factors & age. Clinical Neuropsychology. 24(2): 265 – 285.

27. Fritz, V. 2006. Stroke in South Africa. International Journal of Stroke. 1: 47 – 48.

28. Galski, T., Bruno, R. L., Zorowitz, R. & Walker, J. 1993. Predicting length of stay, functional outcome, and aftercare in the rehabilitation of stroke patients. Ther dominant role of higher-order cognition. Stroke. 24: 1794 – 1800.

29. Glynn, J. R., Carael, M., Auvert, B., Kahindo, M., Chege, J., Musonda, R., Kaona, F. &Buve, A. 2001. Why do young women have a much higher prevalence of HIV than young men? AIDS. 15: S51 – S60.

30. Hallet, M. 2001. Plasticity of the human motor cortex and recovery from stroke. Brain Research Reviews. 36: 169 – 174.

31. Hama, S., Yamashita, H., Shigenobu, M., Watanabe, A., Hiramoto, K., Kurisu, K., Yamawaki, S. &Kitaoka, T. 2007. Depression or apathy and functional recovery after stroke. International Journal of Geriatric Psychiatry. 22: 1046 – 1051.

32. Hartigan, I. 2012. Goal setting in stroke rehabilitation: part 2. How do health professionals set goals and what is the nurse's role? British Journal of Neuroscience Nursing. 8 (3): 123 – 128.

33. Hendricks, H. T., van Limbeek, J., Geurts, A. C., Zwarts, M. J. 2002. Motor recovery after stroke: A systematic review of literature. Archives in Physical Medicine and Rehabilitation. 83: 1629 – 1637.

34. Jacobs, G. B., Loxton, A. G., Laten, A., Robson, B., van Rensburg, E. J. & Engelbrecht, S. 2009. Emergence and diversity of different HIV-1 subtypes in South Africa, 200 – 2001. Journal of Medical Virology. 81 (11): 1852 -1859.

35. Jongbloed, L. 1986. Prediction of function after stroke: a critical review. Stroke. 17: 765 – 776.

36. Kwakkel, G., Kollen, B. & Lindeman, E. 2004. Understanding the pattern of functional recovery after stroke: Facts and theories. Restorative Neurology and Neuroscience. 22: 281 – 299.

37. Lee, D., Sung, H. H., Jung, H. K. &Dae-Il, C. 2011. Stroke subtypes and risk factors of ischemic stroke in young Korean adults. Neurology Asia. 16(4): 281 – 289.

38. Lemogoum, D., Degaute, J. P. & Bovet, P. 2005. Stroke prevention, treatment and rehabilitation in Sub-Saharan African. American Journal of Preventive Medicine. 29: 95 – 101.

39. Longo-Mbenza, B., Mashi, M. L., Tshikwela, M. L., Mokondjimobe, E., Gombet, T., Elenga-Mbolla, B., Okwe, A. N., Kabangu, N. K. &Fuele, S. M. 2011. Relationship between younger age, autoimmunity, cardiometabolic risk, oxidative stress, HAART, and ischemic stroke in Africans with HIV/AIDS. Cardiology.

40. Lund, A., Michelet, M., Sandvik, L., Wyller, T. B. &Sveen, U. 2011. A lifestyle intervention as a supplement to a physical activity programme in rehabilitation after stroke: a randomized controlled trial. Clinical Rehabilitation. 26 (6): 502 – 512.

41. Mbanya, J. C., Motalo, A., Sobngwi, E., Assah, F. K. &Enoru, S. T. 2010. Diabetes in Sub-Saharan Africa. Lancet. 375: 2254 – 66.

42. Melvin, J. L. 1980. Interdisciplinary and multidisciplinary activities and the ACRM. Archives of Physical Medicine and Rehabilitation. 61: 379 – 380.

43. Mochan, A., Modi, M. &Modi, G. 2003. Stroke in black South African HIV-positive patients: A prospective analysis. Stroke. 34: 10.

44. Modi, G., Modi, M. &Mochan, A. 2008. Is stroke a HIV-related neurologic manifestation? Expert Review of Neuro therapeutics. 8 (8): 1247 – 1253.

45. Moore, D. J., Letendre, S. L., Morris, S., Umlof, A., Deutsch, R., Smith, D. M., Little, S., Rooney, A., Franklin, D. R., Gouaux, B., LeBlanc, S., Rosario, D., Fennema-Notestine, C., Heaton, R. K., Ellis, R. J., Hampton Atkinson, J. & Grant, I. 2011. Neurocognitive functioning in acute or early HIV infection. Journal of Neurovirology. 17: 50 – 57.

46. Myles, C. &Breyer, A. 2006. Chapter 14: Stroke in South Africa. Chronic Diseases of Lifestyle in South Africa 1995 – 2005. 195 – 203.

47. Nagel, M. A., Mahalingam, R., Cohrs, R. J. &Gilden, D. 2010. Virus vasculopathy and stroke: An under-recognized cause and treatment target. Infectious Disorders, Drug and Targets. 10(2): 105 – 111.

48. Nentwich, L. M., Magauran, B. G. & Kahn, J. H. 2012. Acute ischemic stroke. Preface. Emergency Medicine Clinics of North America. 30 (3): 15 – 16.

49. Noah, Z., Albayaty, M. A. &Abdulrahim, Y. 2011. Socio-economic elements as a risk factor of ischemic stroke in Iraq. Middle East Journal of Age & Ageing. 8 (6).

50. Norrefalk, J. R. 2003. How do we define multidisciplinary rehab? Journal of Rehabilitation Medicine. 35: 100 – 101.

51. Ogeng'o , J. A., Olabu, B. O., Mburu, A. N. &SInkeet, S. R. 2010. Pediatric stroke in an African country. Journal of Pediatric Neurosciences. 5(1): 22 – 24.

52. Oritz, G., Koch, S., Romano, J. G., Forteza, A. M. &Rabinstein, A. A. 2007. Mechanism of ischemic stroke in HIV-infected patients. Neurology. 68: 1257 – 1262.

53. Ovbiagele, B. &Nath, A. 2011. Increasing incidence of ischemic stroke in patients with HIV infection. Neurology. 76: 444 – 450.

54. Paul, S. L., Srikanth, V. K. & Thrift, A. G. 2007. The large and growing burden of stroke. Current Drug Targets. 8 (7): 786 – 793.

55. Qureshi, A. I. 2005. HIV infection and stroke: If not protein S deficiency then what explains the relationship. Journal of Neurology, Neurosurgery, Psychiatry. 76: 1331.

56. Rigby, H., Gubitz, G. & Phillips, S. 2009. A systematic review of caregiver burden following stroke. International Journal of Stroke. 4 (4): 285 – 292.

57. Robinson-Papp, J., Byrd, D., Mindt, M. R., Oden, N. L., Simpson, D. M. &Morgello, S. 2008. Motor function and human immunodeficiency virus-associated cognitive impairment in a highly active antiretroviral therapy-era cohort. Archives of Neurology. 65 (8): 1096 – 1101.

58. Rossini, P. M., Calautti, C., Pauri, F. & Baron, J – C. 2003. Post-stroke plastic reorganization in the adult brain. Lancet Neurology. 2: 493 – 502.

59. Rusch, M., Nixon, S., Schilder, A., Braitstein, P., Chan, K. & Hogg, R. 2004. Impairments, activity limitations and participation restrictions: Prevalence and association among persons living with HIV/AIDS in British Columbia. Health & Quality of Life Outcomes. 2:46.

60. Saxena, S., Ng, T., Yong, D., Fong, N. & Kohn, G. 2006. Functional outcomes in inpatient rehabilitative care of stroke patients: predictive factors and the effect of therapy intensity. Quality in Primary Care. 14: 145 – 153.

61. Schaetcher, J. D., 2004. Motor rehabilitation and brain plasticity after hemiparetic stroke. Progress in Neurobiology. 73: 61 – 72.

62. Senocak, E., Oguz K. K., Ozgen, B., Kurne, A. Ozkaya, G., Unal, S. &Cila, A. 2010. Imaging features of CNS involvement in AIDS. Diagnostic Intervention Radiology. 16 (3): 193 – 200.

63. Silverstrelli, G., Parnetti, L., Paciaroni, M., Caso, V., Corea, F., Vitali, R., Capachi, G. &Agnelli, G. 2006. Early admission to stroke unit influences clinical outcome. European Journal of Neurology. 13: 250 – 255.

64. Sitbon, O., Lascoux-Combe, C., Delfraussy, J-F., Yeni, P. G., Raffi, F., De Zuttere, D., Gressin, V., Clerson, P., Sereni, D. &Simonneau, G. 2008. Prevalence of HIV-related pulmonary arterial hypertension in the current antiretroviral therapy era. American Journal of Respiratory and Critical Care Medicine. 177: 108 – 113.

65. Skelton, D. A., Greig, C. A., Davies, J. M. & Young, A. 1994. Strength, power & related functional ability of healthy people aged 65 – 89 years. Age and Ageing. 23: 371 – 377.

66. Smith Jr, S.C., Benjamin, E. J., Bonow, R. O., Braun, L. T., Creager, M. A., Franklin, B. A., Gibbons, R. J., Grundy, S. M., Hiratzka, L. F., Jones, D. W., Lloyd-Jones, D. M., Minissian, M., Mosca, L., Peterson, E. D., Sacco, R. L., Spertus, J., Stein, J. H.. &Taubert, K. A. 2011. AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update: A guideline from the American Heart Association and American College of Cardiology Foundation. Circulation. November: 1- 16.

67. Smith, S. C. 2011. Reducing the global burden of ischemic heart disease and stroke: A challenge for the cardiovascular community and the United Nations. Circulation. 124: 278 – 279.

68. Speich, R., Jenni, R., Opravil, M. &Jaccard, R. 2001. Regression of HIV-associated pulmonary arterial hypertension and long-term survival during antiretroviral therapy. Swiss Medical Weekly. 131: 663 – 665.

69. Spengos, K. &Vemmos, K. 2010. Risk factors, etiology, and outcome of first-ever ischaemic stroke in young adults aged 15 to 45 – the Athens young stroke registry. European Journal of Neurology. 17: 1358 – 1364.

70. Stroebele N., Müller-Riemenschneider, F., Nolte, C. H., Müller-Nordhan, J., Bockelbrink, A. &Willich, S. N. 2011. Knowledge of risk factors, and warning signs of stroke: a systematic review from a gender perspective. International Journal of Stroke. 6: 60 – 66.

71. Stuart-Sho, E. M., Wellenius, G. A., Iacono, D. D. &Mittleman, M. A. 2009. Gender differences in presenting and prodomal stroke symptoms. Stroke. 40(4): 1121 – 1126.

72. Tan, I. L., Smith, B. R., van Geldern, G., Mateen, F. J. & McArthur, J. C. 2012. HIV-associated opportunistic infections of the CNS. Lancet Neurology. 11: 605 – 617.

73. Teasell, R., Bayona, N. A. &Bitensky, J. 2005. Plasticity and reorganization of the brain post stroke. Topics in Stroke Rehabilitation. 12(3): 11 – 26.

74. Tipping, B., de Villiers, L., Wainwright, H., Candy, S. &Bryer, A. 2007. Stroke patients with human immunodeficiency virus infection. Journal of Neurology, Neurosurgery & Psychiatry. 78: 1320 – 1324.

75. Tobias, M., Cheung, J., Carter, K., Anderson, C. &Feigin, V. L. 2007. Stroke surveillance: population-based estimates and projections for New Zealand. Australian and New Zealand Journal of Public Health. 31 (6): 520 – 527.

76. Truelson, T., Piechowski-Jozwiak, B., Bonita, R., Mathers, C., Bogousslavsky, J. &Boysen, G. 2006. Stroke incidence and prevalence in Europe: a review of available data. European Journal of Neurology. 13: 581 – 598.

77. Turanjanin, N., Jovicevic, M., Brkic, S., Slankamenac, P., Divjak, I. &Bozic, K. 2001. Prevalence of risk factors in ischemic stroke patients. Journal of Society for development in new net environment in B & H. 5 (5): 1273 – 1280.

78. UNAIDS(2010). Report on the global HIV/AIDS epidemic.www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2010/gr2010/UNAIDS_Global_Report_2010_en.pdf (accessed on 6 March 2010).

79. UNAIDS(2012). Report on the global HIV/AIDS epidemic.www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2012/gr2012/UNAIDS_Global_Report_2012_en.pdf (accessed on 22 January 2012).

80. UNAIDS(2014). Report on the global HIV/AIDS epidemic.www.unaids.org/en/media/unaids/contentassets/documents/epidemiology/2014/gr2014/UNAIDS_Global_Report_2014_en.pdf (accessed on 17 July 2014).

81. UNAIDS(2014). The Gap Report 2014.www.unaids.org/en/resources/campaigns/2014/2014gapreport/gapreport/ (accessed on 17 July 2014).

82. Voytek, B., Davis, M., Yago, E., Barcelo, F., Vogel, E. K. & Knight, R. T. 2010. Dynamic neuroplasticity after human prefrontal cortex damage. Neuron. 68: 401 – 408.

83. Wade, D. T. &Hewer, R. L. 1987. Functional abilities after stroke: measurement, natural history and prognosis. Journal of Neurology, Neurosurgery, and Psychiatry. 50: 177 – 182.

84. Wang, X., Jiang, G., Choi, B. C. K., Wang, D., Wu, T., Pan, Y. &Boulton, M. 2009. Surveillance of trend and distribution of stroke mortality by subtype, age, gender, and geographic areas in Tianjin, China, 1999 – 2006. International Journal of Stroke. 4: 169 – 174.

85. Wasserman, S., de Villiers, L. &Bryer, A. 2009. Stroke care in a rural African setting. International Journal of Stroke. 4: 151.

86. Woods, S. P., Moore, D. J., Weber, E. & Grant, I. 2009. Cognitive neuropsychology of HIV-associated neurocognitive disorders. Neuropsychology Review. 19: 152 – 168.

87. World Health Organization. 2001. ICF: International classification of functioning, disability and health / World Health Organization. Geneva. WHO. 1 – 299.

88. World Health Organization. The World Health Report: 2002: Reducing risks, promoting healthy life. 2002. World Health Organization.

89. www.avert.org/history-aids-1986.htm. History of AIDS up to 1986 (accessed on 22 January 2012).

90. www.heart.org, searched on 6 March 2010 and 22 January 2012.

91. www.sadfm.co.za searched on 6 March 2010.

92. www.statssa.gov.za searched on 17 July 2014.

93. www.stroke.org, searched on 22 January 2012.

94. Young, F., Critchley, J. A., Johnstone, L. K. & Unwin, N. C. 2009. A review of co-morbidity between infectious and chronic disease in Sub Saharan Africa: TB and Diabetes Mellitus, HIV and metabolic syndrome, and the impact of globalization. Globalization and Health. 59: 1 – 9.

Appendix A: ETHICAL CLEARANCE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ms Jenny Janse van Rensburg

CLEARANCE CERTIFICATE	M110493
PROJECT	The Effect of HIV Infection on Functional Recovery in Patients with Stroke
INVESTIGATORS	Ms Jenny Janse van Rensburg.
DEPARTMENT	Department of Physiotherapy
DATE CONSIDERED	06/06/2011
M1104930DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 15/11/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

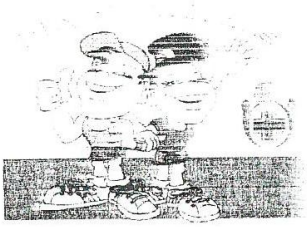
*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr W Mudzi

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

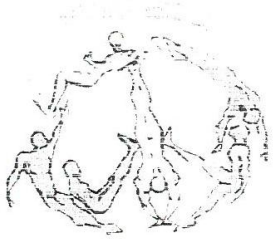
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

Appendix B: Letter for permission from hospital



WITRAND HOSPITAL

PHYSIO OUT-PATIENT DEPARTMENT



Enquiries: Linda v.d. Schyff & Rines Laubscher

Private Bag X 253
Potchefstroom
2520

(018) 294 9156 x 2150

lindav@nwpg.gov.za or
jlaubscher@nwpg.gov.za

8 February 2012

Attention: Mrs. N. L. Mocwaledi-Senyane via Dr T. G. K. Oosthuizen

Re: Permission to commence study

I have received ethical clearance from the University of the Witwatersrand Ethics Committee to start my study (certificate attached). There has been a title change but this has been approved by my supervisors and the assessors' board. Attached to this letter is my amended protocol on which my project will be based. The original title, "The effect of HIV infection on functional recovery in patients with stroke" has been changed to, "The differences in functional status between patients with stroke who are HIV positive and those who are HIV negative". The assessors' board of the School of Therapeutic Sciences felt that the word "effect" implied a causality aspect of the HIV infection which was not the purpose of the study. Thus the change.

Please take note that it was only the title that was changed and the protocol and study content and its concept have remained the same and will yield the results that were originally planned for.

Your approval to release the files in order for me to commence with my data collection would be greatly appreciated as my supervisors would like me to complete my study for June graduation 2012.

Regards,

Jenny Janse van Rensburg
Physiotherapist

Linda v d Schyff
Head of Department

Dr T. G. K. Oosthuizen
Senior Medical Services Manager

Mrs N. L. Mocwaledi-Senyane
Hospital CEO

Recommended / Not recommended

Date: 7/02/2012

Recommended / Not recommended

Date: 2012 -02-

Approved / Not approved

Date:

POTCHEFSTROOM
WITRAND HOSPITAAL
2012 -02- 09

Appendix C: Demographic Questionnaire

CODE:

HIV Status		Positive		Negative
CD4 count		**ARV's**		
Date ARV Rx started				
AdmBeta-score		**D/C Beta-score**		
Gender		Female		Male
Race	African	Caucasian	Coloured	Indian
Age		**Weight**		
D.O.A		**Date of D/C**		
L.O.S		**No. stroke**		
Subtype		Haemorrhage		Ischaemic
D. O. I ***(Date of Incident)***				
Risks	HPT	DM	Cholesterol	Post-natal

Type of Rehabilitation *(Tick appropriate blocks)*											
	Physiotherapy		Occupational therapy		Speech Therapy		Psychology		Dietetics		Medical Officer (daily)

Date: Collected by:

This collection sheet has been coded at random and in no way provides information that can be used to trace the data back to a specific file

Appendix D: Coding Sheet

File Number	Code

Date: Collected by:

APPENDIX E: Beta Scoring Sheet

Multi Professional Team PROGRESS REPORT

PATIENT NAME:
BROAD DIAGNOSES: **D.O.B:** **D.O.A:** **D.O.I:** **HOSP NO:**

DATE	Admis											CAUSE FOR SCORE (reason why score not beta	HOW DETERMINE	DETAILED PLAN (how to correct it)
Eating (OT)														
Grooming (OT)														
Bathing (OT)														
Dressing UL (OT)														
Dressing LL (OT)														
Toileting (OT)														
Bladder (Nursing)														
Bowel (Nursing)														
Transfer bed (Physio)														
Transfer toilet (Physio)														
Transfer tub (Physio)														
Wheelchair (Physio) Walk														
Stairs (Physio)														
Comprehension (SpeechTh)														
Expression (SpeechTh)														
Social interaction (Psychologist)														
Problem solving (Psychologist)														
Memory (Psychologist)														
TOTAL out of 126	0	0	0	0	0	0	0	0			0			